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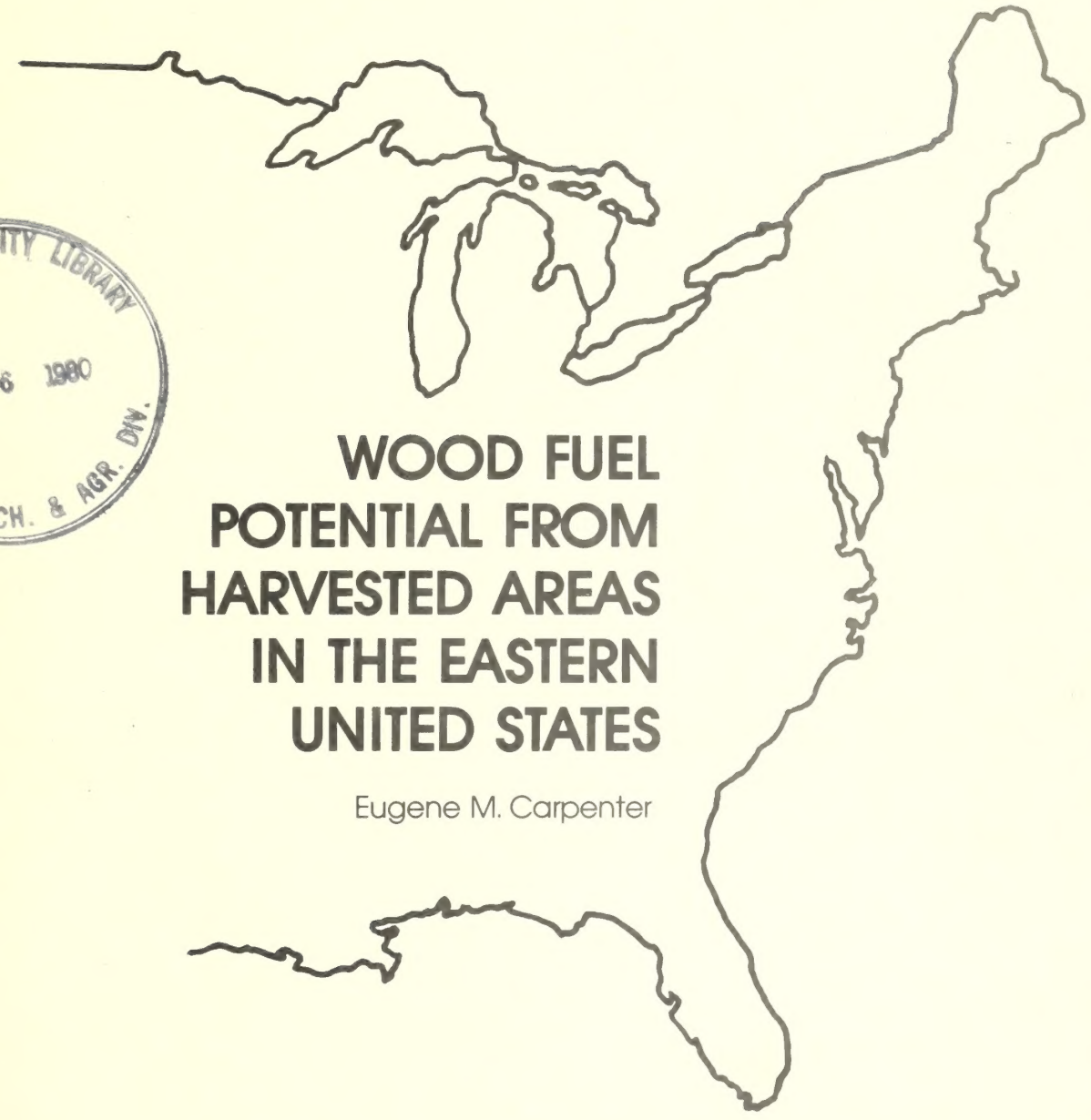

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WOOD FUEL POTENTIAL FROM HARVESTED AREAS IN THE EASTERN UNITED STATES

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Manuscript approved for publication December 3, 1979

1980

WOOD FUEL POTENTIAL FROM HARVESTED AREAS IN THE EASTERN UNITED STATES

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Wood is being reconsidered as a source of energy for both domestic and industrial needs. Estimates show that, although wood can supply only a very small percent of the Nation's energy requirement and therefore is not a panacea for the energy crisis, it can supply a significant amount of energy to selected municipalities, industries, and utilities (Houghton and Johnson 1976, Wahlgren and Ellis 1978).

In this paper, we assess the amount of residues and unutilized wood material potentially available from logging operations in the eastern United States (fig. 1). Salvage of these residue materials could greatly increase the utilization of available fiber. We focus on the potential wood fuel that may be available from harvested areas within reach of the skidder. Included are estimates from sources usually overlooked in forest inventories— cull sections, bark, tops, and limbs. Also included is material from rough and rotten trees and from trees cut on noncommercial and nonforest land. Although we feel that whole tree logging and field chipping would be used to salvage this material, a detailed investigation of the economic factors affecting its recovery is beyond the scope of this report. However, an economic analysis made for the Upper Peninsula of Michigan and northern Wisconsin showed tremendous quantities of material potentially available from all forest sources, with a significant amount available at competitive prices (Energy Research and Development Administration 1978).

Although we emphasize the potential use of residue as a fuel, much of the material may also be suitable for pulp, fiber, or chemicals. Eventual use will depend on the comparative cost of wood residue furnishes relative to other raw material sources.

Forest Resource Evaluation Research (FRER) reports acreage for certain defined land bases and timber volume (called inventory) for several defined tree classes. These breakdowns are based on land and tree quality and/or quantity characteristics. The timber

Figure 1.—*Regions of the eastern United States.*

inventory is not documented on some land bases such as noncommercial or nonforest land. Using information from the inventory of growing stock, rough, rotten, salvable dead, and mortality tree classes, we have estimated an amount of material that may be available from these trees on harvested areas. Also, the amount of timber removed annually for products is estimated by FRER by type of product and the land base and tree class categories from which the material came. Most of the timber removed comes from inventoried tree classes, but some harvest also comes from land bases for which no inventory is documented. Using timber products output data, we have estimated an associated volume of tops, limbs, logging residue, cull sections, and bark for the harvested tree volume. Cubic foot inventory and timber product removal data are presented in *Forest Statistics of the U.S., 1977*, and these data serve as the basis for the tables presented in this report (USDA Forest Service 1978).

We developed a key to show how the various land and tree categories are defined and to describe how the information may be used to develop a broader

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picture of resource potential than is shown in traditional inventory tabulations. The key shows how the information flows through the land base and tree class categories (Part I) to the timber products output tables from which estimates of fuel potential are made (Part II) or, for some tree categories, how an estimate is made directly from inventory data (Part III). Several potential source categories (Part IV) are included for which we did not attempt to estimate a fuel amount.

For example, the land base is categorized as forest land or nonforest land depending on tree stocking and certain physical dimensions. Forest land is classified as either commercial or noncommercial based primarily on site quality. Commercial forest land contains a volume of growing stock trees and nongrowing stock trees or is not stocked at the time of inspection. Growing stock trees can be a source of fiber material through timber products harvest, mortality from natural causes, or removal in cultural operations or land clearing. Removal can also come by administrative edict. When an amount is documented as removed for timber products or left as logging residue, an associated amount of cull sections, tops, limbs, and bark can be estimated.

KEY TO FOREST SURVEY DATA[1]

Part I— Land and Resource Base

1. LAND BASE

   1A. FOREST LAND. Land at least 16.7 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Includes chaparral areas in the West and afforested acres. The minimum forest area classified is 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas are classed as forest if less than 120 feet wide. (Forest statistics of U.S. (FSUS), Table 1.)[2]

   Go to (2)

   1B. NONFOREST LAND. Land that has never supported forests and land formerly forested but where forest use is now precluded by development for nonforest uses such as cropland, improved pastures, residential areas, and city parks. Includes narrow strips of timber (less than 120 feet wide) along improved roads, streams, and shelterbelts when adjoined by land developed for nonforest uses. (FSUS, Table 1.)

   Go to (6)

2. FOREST LAND

   2A. COMMERCIAL FOREST LAND. Forest land that is producing or is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. This includes areas suitable for growing crops of industrial wood generally of a site quality capable of producing in excess of 20 cubic feet per acre of annual growth. Includes inaccessible and inoperable areas. (FSUS, Tables 2-5.)

   Go to (3)

   2B. NONSTOCKED AREAS. Commercial forest land less than 16.7 percent occupied with growing stock trees. Can support noncommercial growth. (FSUS, Tables 3-7.)

   Go to (11)

   2C. NONCOMMERCIAL FOREST LAND.
   (a) Unproductive— forest land incapable of yielding crops of industrial wood because of adverse site conditions. (FSUS, Tables 6,7.)

   Go to (6)

   (b) Productive-reserved— productive forest land withdrawn from commercial timber use through statute or administrative regulation, or exclusively used for growing christmas trees. (FSUS, Tables 6,7.)

   Go to (10)

3. COMMERCIAL FOREST LAND

   3A. GROWING STOCK. Net volume of growing-stock trees at least 5 inches in diameter at breast height (4.5 feet) from a 1-foot stump to a minimum 4.0-inch top diameter outside bark of the central stem or to the point where the central stem breaks into limbs. These are live trees of commercial species that meet specified standards of size and quality. Excludes rough, rotten, and dead trees, and trees of noncommercial species. (FSUS, Tables 10-12, 15, 16, 19, 20, 23, 25, 26, 29.)

   Go to (4)

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[1] *Categories for which cubic foot inventory volumes are reported are shown in capital letters in the key. Amounts estimated by applying factors to these volumes are shown in lower case letters.*

[2] *Tables cited show data source from* ***Forest Statistics of the United States, 1977, (FSUS)*** *(USDA Forest Service 1978).*

3B. NONGROWING STOCK. Other than growing stock trees. The sound volume of rough, rotten, and salvable dead trees, including noncommercial species. Also includes saplings (trees less than 5 inches in diameter at breast height (4.5 feet)). (FSUS, Table 5.)

Go to (5)

4. GROWING STOCK SOURCE

4A. TIMBER PRODUCTS OUTPUT. The volume of products harvested from growing stock trees. (FSUS, Tables 47-67.)

Go to (7A)

4B. MORTALITY OF GROWING STOCK. The volume of sound wood in live sawtimber and poletimber trees dying from natural causes in a specified period. Natural causes include fire, insect, disease, animal, weather, and suppression. (FSUS, Tables 33, 45.)

Go to (8)

4C. OTHER REMOVALS. The net volume of growing-stock trees removed from the inventory by cultural operations (such as timber stand improvement), land clearings, and changes in land use and not utilized for timber products. (FSUS, Tables 47-67, 69.)

Go to (10)

5. NONGROWING STOCK SOURCE

5A. ROUGH TREES. Live trees of commercial species that do not contain at least one merchantable 12-foot saw log or two noncontiguous saw logs each 8 feet or longer, now or prospectively, because of roughness or poor form. All noncommercial species.

(a) TIMBER PRODUCTS OUTPUT. Volume of products harvested from rough trees. (FSUS, Tables 47-67.)

Go to (7B)

(b) Excess of harvested volume.

Go to (9)

5B. ROTTEN CULL TREES. Live trees of commercial species that do not contain a saw log, now or prospectively, because of rot (that is, when more than 50 percent of the cull volume of the tree is rotten).

(a) TIMBER PRODUCTS OUTPUT. Volume of products harvested from rotten trees. (FSUS, Tables 47-67.)

Go to (7B)

(b) Excess of harvested volume.

Go to (9)

5C. SALVABLE DEAD TREES. Standing or fallen dead trees that are considered merchantable by regional standards.

(a) TIMBER PRODUCTS OUTPUT. Volume of products harvested from salvable dead trees. (FSUS, Tables 47-67.)

Go to (7B)

(b) Excess of harvested volume.

Go to (9)

5D. SAPLINGS. Live trees of commercial species 1 to 5 inches in diameter at breast height (4.5 feet) and of good form and vigor. (FSUS, Tables 3, 8, 9.)

Go to (12)

6. NONCOMMERCIAL FOREST LAND AND NONFOREST LAND

Go to (7C)

Part II— The Following Potentials are Determined From Forest Survey Timber Harvest Studies

7. TIMBER PRODUCTS OUTPUT. All timber products cut from roundwood and all byproducts of wood processing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary processing plants include slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores, clippings, and screenings of pulpmills that are used as pulp chips or other products. (FSUS, Tables 47-67.)

7A. TIMBER REMOVALS FROM GROWING STOCK. The volume of sound wood in live sawtimber and poletimber trees removed for forest products (including roundwood products), logging residues, and other removals. Roundwood products are logs, bolts, or other round sections cut from trees. Logging residues are the unused growing stock portions of cut trees plus unused trees killed by logging. Other removals are growing-stock trees removed by cultural operations (such as timber stand improvement), land clearing, and changes in land use. (FSUS, Tables 47-67.)

(a) PRODUCTS REMOVED. (THOUSAND CUBIC FEET) (FSUS, Tables 47-67.)

(a-1) Cull section wood
- 7.5 percent of sound, growing stock products for softwoods[3]
- 15.0 percent of sound, growing stock products for hardwoods

(a-2) Cull section bark
- 15.0 percent of cull wood

(a-3) Tops and limbs, including bark
- 30 percent of above ground tree weight for softwoods
- 35 percent of above ground tree weight for hardwoods

(b) LOGGING RESIDUES. Unused portions of growing stock from trees cut or killed by logging.

(a-1) Wood (FSUS Tables 47-67, 69.)

(a-2) Bark
- 15 percent of wood weight

7B. TIMBER PRODUCTS FROM NONGROWING STOCK (ROUGH, ROTTEN, AND SALVABLE DEAD TREES)

(a) PRODUCTS REMOVED. (THOUSAND CUBIC FEET) (FSUS, Tables 47-67.)

(a-1) Cull section wood
- 25 percent of product wood for rough softwood trees
- 30 percent of product wood for rough hardwood trees
- 50 percent of product wood for rotten trees
- 20 percent of product wood for salvable dead softwoods
- 30 percent of product wood for salvable dead hardwoods

(a-2) Cull section bark
- 15 percent of wood volume

(a-3) Tops and limbs, including bark
- 30 percent of above ground tree weight for softwoods
- 35 percent of above ground tree weight for hardwoods

7C. TIMBER PRODUCTS FROM OTHER SOURCES. Timber products output from trees on noncommercial or nonforest land.

(a) PRODUCTS REMOVED. (THOUSAND CUBIC FEET) (FSUS, Tables 47-67.)

(a-1) Cull section wood
- 25 percent of product wood for rough softwood trees
- 30 percent of product wood for rough hardwood trees
- 50 percent of product wood for rotten trees
- 20 percent of product wood for salvable dead softwoods
- 30 percent of product wood for salvable dead hardwoods

(a-2) Cull section bark
- 15 percent of wood volume

(a-3) Tops and limbs, including bark
- 30 percent of above ground tree weight for softwoods
- 35 percent of above ground tree weight for hardwoods

Part III—The Following Potentials are Determined by Estimating the Distribution on Harvested Areas Using Ratio of Growing Stock Harvested to Growing Stock Inventory

8. MORTALITY

8A. STEMWOOD. (THOUSAND CUBIC FEET (FSUS, Tables 33, 45.)

(a) Stem bark
- 10 percent of stemwood

(b) Cull section wood
- 7.5 percent of sound growing stock products for softwoods
- 15 percent of sound growing stock products for hardwoods

(c) Cull section bark
- 10 percent of cull wood

(d) Tops and limbs, including bark
- 20 percent of above ground weight for softwoods
- 25 percent of above ground weight for hardwoods

9. EXCESS OF HARVESTED NONGROWING STOCK. The volume of nongrowing stock stem wood, cull sections, and tops and limbs estimated to be available on harvested areas but trees from which no products were removed.

(a) Stemwood
- Estimated from inventory ratio less products removed

(b) Stem bark
- 10 percent of stemwood

[3]*Factor for converting cubic foot wood volume to dry weight was 27.5 pounds per cubic foot for softwoods and 33.0 pounds per cubic foot for hardwoods.*

(c) Cull section wood
- 7.5 percent of sound, growing stock products for softwoods
- 15 percent of sound, growing stock products for hardwoods

(d) Cull section bark
- 10 percent of cull wood

(e) Tops and limbs, including bark
- 20 percent of above ground weight for softwoods
- 25 percent of above ground weight for hardwoods

Part IV— Fuel Potentials are not Estimated for the Following Categories

10. OTHER REMOVALS SOURCES
    10A. STAND IMPROVEMENT. Thinning, release cutting, girdling, weeding, or poisoning of unwanted trees aimed at improving growing conditions. (FSUS, Tables 47-67, 69.)
    10B. PRODUCTIVE-RESERVED FOREST LAND. Forest land sufficiently productive to qualify as commercial timber land but withdrawn from timber utilization through statute or administrative designation. (FSUS, Tables 6,7.)
11. NONSTOCKED AREAS. Commercial timber land less than 10 percent occupied with growing stock trees. (FSUS, Tables 3-7.)
12. SAPLINGS. Live trees of commercial species 1 to 5 inches in diameter at breast height (4.5 feet) and of good form and vigor. (FSUS, Tables 3, 8, 9.)

METHODS AND FUEL ESTIMATES

The purpose of the key is to define and identify the sources of information for estimating the potential amount of wood fuel. Basically, we want to estimate the amount of fuel that could be obtained from current harvesting operations and to point out where gaps exist in the data base for estimating additional fuel potentials.

The bulk of the current timber harvest comes from growing stock timber on commercial forest land. After products are removed, the logging residue, cull sections, tops, and limbs of the harvested trees remain on the ground. This logging residue is specifically defined as material included in the growing stock portion of a harvested tree that was not removed as product. It is not the total accumulation of logging slash often thought of more generally as logging residue. The volume of products removed and the amount of logging residue are documented in studies by FRER personnel and are presented in timber product output tables. The additional volume of cull sections, tops, and limbs are estimated from factors developed from studies by Hitchcock *et al.* (1979), Keays (1975), and Young (1976) (tables 1 and 2).

In addition to this growing-stock harvest, nongrowing-stock trees are also available for harvest. The volume of these trees on harvested areas is determined as a ratio of growing stock harvested to growing stock inventory. We assumed that rough, rotten, and salvable dead trees are randomly scattered in Eastern forests and would be available for cutting. However, products are removed from some of these nongrowing-stock tree classes and potential fuel from these harvested cull trees would be available from cull sections, tops, and limbs (tables 3 and 4). Additionally, because all nongrowing stock trees estimated to be on the harvested acres are not cut for products, we estimate an amount in which the entire trees, including the stemwood, would be available for fuel. We call this the excess nongrowing stock (tables 5 and 6). This excess amount is the difference between the total amount of sound nongrowing-stock volume estimated to be on harvested areas less the amount of products removed from this class of trees.

Data are available showing both the total inventory and the amount of products harvested from growing-stock and nongrowing-stock tree classes on commercial forest land. Information is available for two other classes of growing-stock removals. First, an amount is removed for forest improvement cutting, cleared land, and land reserved for nontimber uses. No products are removed in these operations but the amount is documented as other removals from growing stock. Second, an amount is removed for mortality, i.e., the annual volume of growing stock that dies. All dead trees on harvested acres should be available for fuel. We have estimated an amount of mortality on harvested acres using the same ratio technique as with nongrowing-stock trees (table 7).

To this point, we have accounted for inventory and removals of growing stock, nongrowing stock, and mortality on commercial forest land. Information is available showing the amount of timber products cut from a category called "other sources", that is, from noncommercial and nonforest land. Because no inventory data are available for this class of material,

our estimate of fuel potential is limited to the cull sections, tops, and limbs from harvested trees (table 8). Here, we presume that the sound bole volumes were removed for products, and the estimated volume of tops, limbs, cull sections, and bark is associated with this removal.

Using the data bases, the ratio of growing stock harvested to growing stock inventory (to estimate the location of certain tree classes on harvested acres) and the softwood and hardwood conversion factors (to estimate the volume of cull sections, bark, tops, and limbs) we estimated the potential wood fuel from current harvesting operations in the eastern United States (table 9).

Table 1.—*Estimated potential fuel from harvested growing stock, 1976*

Region	Growing stock harvest		Cull sections[1]			Logging residues			Tops and Limbs	Total residue
			Wood	Bark[2]	Total	Wood	Bark[2]	Total		
	10^6 cu. ft.	*M tons*	*Thousand dry tons[4]*							
SOFTWOODS										
Northeast	395	5,431	407	61	468	888	133	1,021	3,315	4,804
North central	151	2,077	156	23	179	62	9	71	1,131	1,381
Subtotal	546	7,508	563	84	647	950	142	1,092	4,446	6,185
Southeast	1,720	23,645	1,773	266	2,039	1,944	292	2,236	13,486	17,761
South central	2,301	31,643	2,373	356	2,729	1,525	229	1,754	17,517	22,000
Subtotal	4,021	55,288	4,146	622	4,768	3,469	521	3,990	31,003	39,761
Total	4,567	62,796	4,709	706	5,415	4,419	663	5,082	35,449	45,946
HARDWOODS										
Northeast	542	8,941	1,341	201	1,542	2,645	397	3,042	8,002	12,586
North central	720	11,882	1,782	267	2,049	1,640	246	1,886	9,477	13,412
Subtotal	1,262	20,823	3,123	468	3,591	4,285	643	4,928	17,479	25,998
Southeast	631	10,417	1,563	234	1,797	2,552	383	2,935	8,998	13,730
South central	858	14,162	2,124	319	2,443	2,331	350	2,681	11,528	16,652
Subtotal	1,489	24,579	3,687	553	4,240	4,883	733	5,616	20,526	30,382
Total	2,751	45,402	6,810	1,021	7,831	9,168	1,376	10,544	38,005	56,380
SOFTWOODS AND HARDWOODS										
Total	7,318	108,198	11,519	1,727	13,246	13,587	2,039	15,626	73,454	102,326

[1]Cull section wood weight is estimated to be 7.5 percent of sound growing stock wood weight for softwoods and 15 percent for hardwoods.

[2]Bark is estimated to be 15 percent of the wood for cull sections and logging residue.

[3]Top and limb weight includes bark and foliage and is estimated to be 30 percent of the above-ground tree weight including stemwood, cull sections, and logging residue for softwoods and 35 percent for hardwoods.

[4]Factor for converting cubic foot wood volume to dry weight was 27.5 pounds per cubic foot for softwoods and 33.0 pounds per cubic foot for hardwoods.

Table 2.—*Estimated potential softwood fuel from harvested nongrowing stock, 1976*

Tree Class	Product removals[1]		Cull sections[2]			Tops and limbs[4]	Total
			Wood	Bark[3]	Total		
	10^3 cu. ft.	*M tons*[5]	*Thousand dry tons*[6]				
NORTHEAST							
Rough		65	16	3	19	40	59
Rotten	5,282	7	4	1	4	5	10
Salvable dead	6,348	87	18	3	20	52	72
Subtotal	11,630	159	38	7	43	97	141
NORTH CENTRAL							
Rough		21	5	1	6	13	19
Rotten	1,661	2	1	0	1	2	3
Salvable dead	1,444	20	4	1	5	12	16
Subtotal	3,105	43	10	2	12	27	38
Total	14,735	202	48	9	55	124	179
SOUTHEAST							
Rough		391	98	15	112	241	353
Rotten	31,564	43	22	3	25	32	57
Salvable dead	15,927	219	44	7	50	130	180
Subtotal	47,491	653	164	25	187	430	590
SOUTH CENTRAL							
Rough		132	33	5	38	81	119
Rotten	10,629	15	7	1	8	11	19
Salvable dead	1,583	22	4	1	5	13	18
Subtotal	12,212	169	44	7	51	105	156
Total	59,703	822	208	32	238	508	746
Total	74,438	1,024	256	41	193	632	925

[1]Does not include bark.

[2]Cull section wood is estimated to be 25 percent for rough trees, 50 percent for rotten trees, and 20 percent for salvable dead trees of soundwood volume (inventory or product volume).

[3]Bark is estimated to be 15 percent of wood volume.

[4]Tops and limbs, including bark and foliage, are estimated to be 30 percent of total above ground tree weight.

[5]Output of products from rough and rotten trees is estimated to be 90 percent from rough trees and 10 percent from rotten trees.

[6]Factor for converting cubic foot wood volume to dry weight is 27.5 pounds per cubic foot.

Table 3.—*Estimated potential hardwood fuel from harvested nongrowing stock, 1976*

Tree Class	Product removals[1]		Cull sections[2]			Tops and limbs[4]	Total
			Wood	Bark[3]	Total		
	10^3 cu. ft.	*M tons*[5]	*Thousand dry tons*[6]				
NORTHEAST							
Rough		228	68	10	79	184	262
Rotten	15,349	25	13	2	15	24	38
Salvable dead	8,417	139	42	6	48	112	160
Subtotal	23,766	392	123	18	142	320	460
NORTH CENTRAL							
Rough		1,167	350	53	403	939	1,342
Rotten	78,562	130	65	10	75	120	195
Salvable dead	23,295	384	115	17	133	309	442
Subtotal	101,857	1,681	530	80	611	1,368	1,979
Total	125,623	2,073	653	98	753	1,688	2,439
SOUTHEAST							
Rough		1,075	323	48	371	866	1,237
Rotten	72,408	120	60	9	69	111	180
Salvable dead	2,784	46	14	2	16	37	53
Subtotal	75,192	1,241	397	59	456	1,014	1,470
SOUTH CENTRAL							
Rough		489	147	22	169	394	563
Rotten	32,937	54	227	4	31	51	82
Salvable dead	10,446	172	52	8	60	139	198
Subtotal	43,383	715	226	34	260	584	843
Total	118,575	1,956	623	93	716	1,598	2,313
Total	244,198	4,029	1,276	191	1,469	3,286	4,752

[1]Does not include bark.

[2]Cull section wood is estimated to be 25 percent for rough trees, 50 percent for rotten trees, and 20 percent for salvable dead trees of soundwood volume (inventory or product volume).

[3]Bark is estimated to be 15 percent of wood volume.

[4]Tops and limbs, including bark and foliage, are estimated to be 30 percent of total above ground tree weight.

[5]Output of products from rough and rotten trees is estimated to be 90 percent from rough trees and 10 percent from rotten trees.

[6]Factor for converting cubic foot wood volume to dry weight is 27.5 pounds per cubic foot.

Table 4.—*Estimated potential softwood fuel from excess nongrowing stock on harvested areas, 1976*

(In thousand dry tons)[1]

Tree class	Stem section[2]			Cull section[3]			Tops and limbs[5]	Total
	Wood	Bark[4]	Total	Wood	Bark[4]	Total		
NORTHEAST								
Rough	418	63	481	105	16	120	258	859
Rotten	172	26	198	86	13	99	127	424
Subtotal	590	89	679	191	29	219	385	1,283
NORTH CENTRAL								
Rough	43	6	49	11	2	12	26	88
Rotten	19	3	22	10	1	11	14	47
Subtotal	62	9	71	21	3	23	40	135
Total	652	98	750	212	232	242	425	1,418
SOUTHEAST								
Rough	106	16	122	26	4	30	65	217
Rotten	48	7	55	24	4	27	35	118
Subtotal	154	23	177	50	8	57	100	335
SOUTH CENTRAL								
Rough	260	39	299	65	10	75	160	534
Rotten	229	34	264	115	17	132	170	565
Salvable dead	10	2	12	2	0	2	6	20
Subtotal	499	75	575	182	27	209	336	1,119
Total	653	98	752	232	35	266	436	1,454
Total East	1,305	196	1,502	444	67	508	861	2,872

[1]Factor for converting cubic foot wood volume to dry weight is 27.5 pounds per cubic foot.

[2]There was no salvable dead inventory in excess of product removals except in the South Central region.

[3]Cull section wood is estimated to be 25 percent for rough trees, 50 percent for rotten trees, and 20 percent for salvable dead trees of sound wood inventory volume.

[4]Bark is estimated to be 15 percent of wood volume.

[5]Tops and limbs, including bark and foliage, are estimated to be 30 percent of total above ground tree weight.

Table 5.—*Estimated potential hardwood fuel from excess nongrowing on harvested areas, 1976*

(In thousand dry tons)[1]

Tree class	Stem section[2]			Cull section[3]			Tops and limbs[5]	Total
	Wood	Bark[4]	Total	Wood	Bark[4]	Total		
NORTHEAST								
Rough	946	142	1,088	284	43	326	762	2,176
Rotten	694	104	798	347	52	399	645	1,842
Subtotal	1,640	246	1,886	631	95	725	1,407	4,018
NORTH CENTRAL								
Rough	344	52	395	103	16	119	277	790
Rotten	390	59	448	195	29	224	362	1,034
Subtotal	734	111	843	298	45	343	639	1,824
Total	2,374	357	2,729	929	140	1,068	2,046	5,842
SOUTH EAST								
Rough	1,404	211	1,615	421	63	485	1,131	3,230
Rotten	521	78	599	260	39	299	484	1,382
Subtotal	1,925	289	2,214	681	102	784	1,615	4,612
SOUTH CENTRAL								
Rough	2,656	388	3,054	797	120	916	2,138	6,108
Rotten	1,237	186	1,423	619	93	712	1,149	3,284
Subtotal	3,893	574	4,477	1,416	213	1,628	3,287	9,392
Total	5,818	863	6,691	2,097	315	2,412	4,902	14,004
Total East	8,192	1,220	9,420	3,026	455	3,480	6,948	19,846

[1]Factor for converting cubic foot wood volume to dry weight is 33 pounds per cubic foot.

[2]There was no salvable dead inventory in excess of product removals.

[3]Cull section wood is estimated to be 30 percent for rough trees and 50 percent for rotten trees of sound wood inventory volume.

[4]Bark is estimated to be 15 percent of wood volume.

[5]Tops and limbs, including bark and foliage, are estimated to be 35 percent of total above ground tree weight.

Table 6.—*Summary of estimated potential fuel from residues from conventional harvesting operations, by source, 1976*

(In thousand dry tons)

Region	Residue from harvested growing stock		Residue from harvested nongrowing stock		Residue from excess nongrowing stock		Total		
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Total
Northeast	4,804	12,586	141	460	1,283	4,018	6,228	17,064	23,292
North Central	1,381	13,412	38	1,979	135	1,824	1,554	16,945	18,499
Subtotal	6,185	25,998	179	2,439	1,418	5,842	7,782	34,009	41,791
Southeast	17,761	13,730	590	1,470	335	4,612	18,686	19,812	38,498
South Central	22,000	16,652	156	843	1,119	9,392	23,275	26,887	50,162
Subtotal	39,761	30,382	746	2,313	1,454	14,004	41,961	46,699	88,660
Total	45,946	56,380	925	4,752	2,872	19,846	49,743	80,708	130,451

Table 7.—*Estimated potential fuel from mortality on harvested areas, 1976*

Region	Total mortality	Stem section			Cull section[1]			Tops and limbs[2]	Total residue
		Wood	Bark[3]	Total	Wood	Bark[3]	Total		
	10^3 cu. ft.	*Thousand dry tons[4]*							
SOFTWOODS									
Northeast	195,241	39.2	3.9	43.2	2.9	0.3	3.2	11.6	58.0
North Central	164,868	25.0	2.5	27.5	1.9	0.2	2.1	7.4	37.0
Subtotal	360,109	64.2	6.4	70.7	4.8	0.5	5.3	19.0	95.0
Southeast	300,194	160.9	16.1	177.0	12.1	1.2	13.3	47.6	237.8
South Central	184,660	124.8	12.5	137.3	9.4	0.9	10.3	36.9	184.5
Subtotal	484,854	285.7	28.6	314.3	21.5	2.1	23.6	84.5	422.3
Total East	844,963	349.9	35.0	385.0	26.3	2.6	28.9	103.5	517.3
HARDWOODS									
Northeast	501,604	84.8	8.5	93.3	12.7	1.3	14.0	35.8	143.1
North Central	500,242	109.7	11.0	120.7	16.4	1.6	18.1	46.2	185.0
Subtotal	1,001,846	194.5	19.5	214.0	29.1	2.9	32.1	82.0	328.1
Southeast	286,783	71.0	7.1	78.1	10.6	1.1	11.7	29.9	119.8
South Central	315,859	100.4	10.0	110.4	15.0	1.5	16.6	42.3	169.3
Subtotal	602,642	171.4	17.1	188.5	25.6	2.6	28.3	72.2	289.1
Total East	1,604,488	365.9	36.6	402.5	54.7	5.5	60.4	154.2	617.2
SOFTWOODS AND HARDWOODS									
Total East	2,449,451	715.8	71.6	787.5	81.0	8.1	89.3	157.7	1,134.5

[1] Cull section wood weight is estimated to be 7.5 percent of sound growing stock wood weight for softwoods and 15 percent for hardwoods.

[2] Top and limb weight for mortality trees is estimated to be 20 percent of the total above ground tree weight for softwoods and 25 percent for hardwoods.

[3] Bark is estimated to be 10 percent of the wood weight for mortality trees.

[4] Factor for converting cubic foot wood volume to dry weight was 27.5 pounds per cubic foot for softwoods and 33 pounds per cubic foot for hardwoods.

Table 8.—*Estimated potential fuel for timber harvested from other sources,*[1] *1976*

Region	Harvested	Other sources	Cull section[2]			Tops and limbs[2]	Total
			Wood	Bark	Total		
	10^6 cu. ft.	*M tons*	*Thousand dry tons*[3]				
SOFTWOODS							
Northeast	55	757	189.1	28.4	217.5	466.1	683.6
North Central	9	125	31.3	4.7	36.0	77.1	113.1
Subtotal	64	882	220.4	33.1	253.5	543.2	796.7
Southeast	86	1,178	294.4	44.2	338.5	725.5	1,064.1
South Central	67	926	231.4	34.7	266.1	570.3	836.4
Subtotal	153	2,104	525.8	78.9	604.6	1,295.8	1,900.5
Total East	217	2,986	746.2	112.0	858.1	1,839.0	2,697.2
HARDWOODS							
Northeast	30	496	148.9	22.3	171.2	399.6	570.8
North Central	95	1,565	469.3	70.4	539.8	1,259.5	1,799.3
Subtotal	125	2,061	618.2	92.7	711.0	1,659.1	2,370.1
Southeast	26	436	130.7	19.6	150.3	350.6	500.9
South Central	57	939	281.7	42.3	324.0	755.9	1,079.9
Subtotal	83	1,375	412.4	61.9	474.3	1,106.5	1,580.8
Total East	208	3,436	1,030.6	154.6	1,185.3	2,765.6	3,950.9
SOFTWOODS AND HARDWOODS							
Total East	425	6,422	1,776.8	266.6	2,043.4	4,604.6	6,648.1

[1]Other sources— timber products cut from trees on noncommercial or nonforest land.

[2]Factors for cull section, tops and limbs, and bark are the same as for harvested rough trees in tables 2 and 3.

[3]Factor for converting cubic foot wood volume to dry weight was 27.5 pounds per cubic foot for softwoods and 33 pounds per cubic foot for hardwood

Table 9.—*Distribution of estimated potential fuel by source and area, eastern United States, 1976*

Source	Total		Total residue		North				South			
			Softwoods	Hardwoods	Softwoods		Hardwoods		Softwoods		Hardwoods	
	M tons	*Per-cent*[1]	*M tons*	*M tons*	*M tons*	*Per-cent*[1]	*M tons*	*Per-cent*[1]	*M tons*	*Per-cent*[1]	*M tons*	*Per-cent*[1]
Harvested growing stock	102,326	74	45,946	56,380	6,185	6	25,998	25	39,761	39	30,382	30
Harvested nongrowing stock	5,677	4	925	4,752	179	3	2,439	43	746	13	2,313	41
Excess nongrowing stock	22,718	16	2,872	19,846	1,418	6	5,842	26	1,454	6	14,004	62
Mortality	1,134	1	517	617	95	8	328	29	422	37	289	26
Harvested other sources	6,648	5	2,697	3,951	797	12	2,370	36	1,901	29	1,581	24
Total	138,503		52,957	85,546	8,674		36,977		44,284		48,569	

[1]Portion of total residue by area and species within each individual residue source.

CONVERSION FACTORS

Reliable factors are available to convert cubic foot volumes to a weight basis and to estimate the weight of accompanying tops, limbs, bark, and cull sections. The factors used in this report have been developed from many different weight and biomass studies that predict the tonnage of these components based on the weight of the sound tree bole (growing stock) (Hitchcock *et al.* 1979, Keays 1975, Young 1976). These factors provide reasonable estimates of the total forest inventory tonnage and bring into perspective the opportunity for providing increased amounts of wood fiber for fuel and other uses.

More reliable weight predictions will be possible when individual species regression equations are incorporated into forest survey data analysis systems and when the potential amount of material available from intermediate cuts is estimated. The Forest Resource Evaluation Program tree growth projection system developed at the North Central Forest Experiment Station offers the opportunity to predict potential yields from various cutting schedules (USDA Forest Service 1979). For the time being, however, estimates must be made from available information.

The various factors used to estimate unreported tonnages are shown in the Key and in table footnotes. Basic estimates of tree component proportions are patterned after Young's composite for all species (fig. 2) (Young 1977).

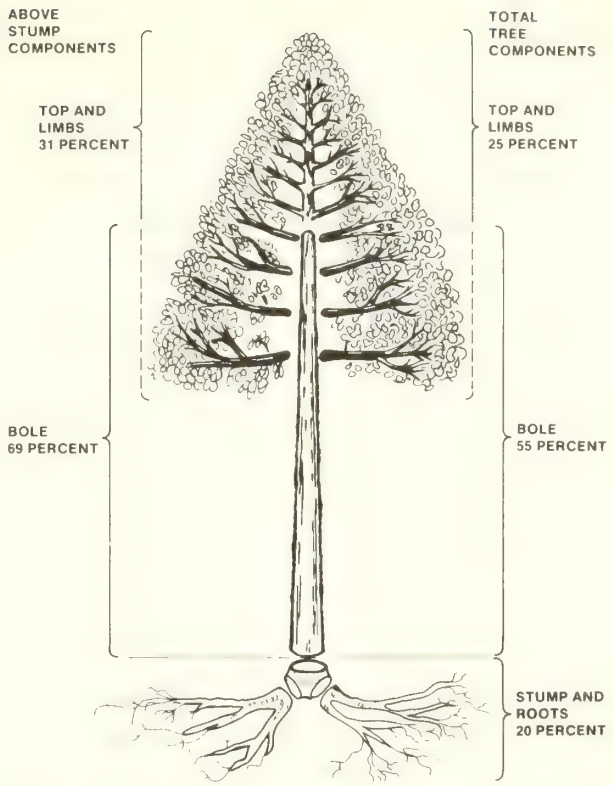

Figure 2.—*Fresh weight components of complete trees and shrubs.*

DISCUSSION

Using inventory data for 1976, we estimate a potential fuel source of 138 million dry tons a year from forest residues in the eastern United States. This amount would be available from harvested acres if all cull sections, logging residue, tops, and limbs from trees cut for products were salvaged, and if all rough, rotten, salvable dead, and mortality trees on harvested areas were removed at the time of cutting. The 138 million tons has an energy potential of 2.35 quads Btu.

Some aspects of the determination of fuel potential from harvested acres would suggest a much larger amount might be available from some sources. The extent that some mortality is concentrated in burned or insect-infected areas rather than randomly scattered might reduce the amount expected to be on harvested acres. On the other hand, if these concentrations are not salvaged because of low product marketability, a fuel market might offer the opportunity to salvage these concentrated volumes, causing a somewhat larger amount to be readily available.

We did not estimate the potential from noncommercial timber stand improvement operations even though an estimate is made of the amount removed from growing stock. In the first place, the data are confounded with amounts removed through withdrawals from utilization. Secondly, the potential amount of fiber available from areas needing thinning or other cultural work is undoubtedly huge when compared to the amount actually cut, whether products are removed or not. But, determination of an amount would require more detailed knowledge of stand stocking and a harvest technology for removing material from partial cuts without damaging the residual stand. The use of this material for fuel could provide the incentive where markets have been lacking in the past.

Material that could be removed from nonstocked areas and logging residue from nongrowing-stock trees might add additional amounts to the estimate. The latter would be material included in the inventory but not removed in harvesting products from

this source. A significantly larger but undocumented amount of material could also be available from the noncommercial and nonforest land sources.

From a practical standpoint, the lack of a harvest technology to remove whole trees intact in partial cuts or to remove tops, limbs, and cull trees in a separate relogging operation would reduce the potential fuel from growing-stock harvests. How serious this might be is unknown. Both situations are being researched at the Forestry Sciences Laboratory in Houghton, Michigan (Biltonen *et al.* 1976).

SUMMARY

Two-thirds of the forest residue in the eastern United States is concentrated in the South where it is equally divided between softwoods and hardwoods. The remaining one-third of the residue is in the North and is 80 percent hardwood and 20 percent softwood. Material from harvested growing stock accounts for nearly 75 percent of the total. Another 16 percent comes from rough, rotten, and salvable dead trees from which products were not taken. All of this residue adds up to 138 million tons of material per year that could be used for fuel if conditions and technology existed to get it out of the forests.

Although wood is not the only answer to the world's energy problem, significant plant investments are being made to use it to satisfy industrial, utility, and municipal energy needs. This trend should continue as the price of alternative fuels increases and as the infrastructure to supply and utilize wood fuel develops.

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Carpenter, Eugene M.

1980. Wood fuel potential from harvested areas in the eastern United States. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-51, 14 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

Estimates amount of wood fiber that could be available for fuel from forest residues on harvested areas in the eastern United States. Includes a key to resource data published by the USDA Forest Service and factors for estimating amounts of cull, bark, tops, and limbs from inventory and product output tabulations.

KEY WORDS: Key to Forest Resource Statistics, conversion factors, forest resource definitions, forest residue utilization.

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John S. Spencer, Jr., and Pamela J. Jakes

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1980

FOREWORD

This report presents Iowa's forest resources in 1974 as found by the second Forest Survey of the State. It provides information concerning forest area, timber inventory, growth, mortality, removals, timber products output, future timber supply, forest management opportunities, and nontimber resources. It compares some of these findings with those of the 1954 survey.

Resources Evaluation (formerly called Forest Survey) is a continuing endeavor as mandated by the Forest and Rangeland Renewable Resources Planning Act of 1974, which was preceded by the McSweeney-McNary Forest Research Act of 1928. Its objective is to inventory periodically the nation's forest land to determine its extent, condition, and volumes of timber, growth, and depletions. This kind of up-to-date information is essential to frame intelligent forest policies and programs. USDA Forest Service regional experiment stations are responsible for conducting these inventories and for publishing summary reports for individual States. The North Central Forest Experiment Station is responsible for Resources Evaluation work done in Michigan, Wisconsin, Minnesota, North Dakota, eastern South Dakota, Nebraska, Iowa, Illinois, Indiana, Missouri, and Kansas.

Fieldwork for the 1974 Iowa Forest Inventory was begun in May 1973 and completed in June 1974. The report of the first inventory in 1954 provides a basis for comparing the information in this report for those interested in trends that have developed during the past 20 years.

Personnel from the Iowa Conservation Commission canvassed primary wood-using plants in the State, which helped in estimating the quantity of timber products harvested in Iowa. Iowa District Foresters also canvassed a sample of rural households to determine the quantity of fuelwood, posts, and miscellaneous timbers cut on private, nonindustrial land.

The USDA Agricultural Stabilization and Conservation Service furnished aerial photos used in the survey.

The following persons assisted in the Iowa survey: North Central Forest Experiment Station, Resources Evaluation Project:

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HIGHLIGHTS

Forest Area

Forest land in Iowa totaled 1,561 thousand acres in 1974, down 34 percent from the 2,348 thousand acres in 1954.

Commercial forest land amounted to 1,459 thousand acres in 1974, a 36 percent plunge from the 2,297 thousand acres in 1954. Conversion of commercial forest to pasture or other agricultural uses is the primary reason for the decline.

Oak forest types covered 56 percent of the commercial forest area. The white oak-red oak-hickory type was largest with 515 thousand acres.

Sawtimber stands (54 percent of the commercial forest area) and poletimber stands (24 percent) dominated the State in 1974.

Farmers owned two-thirds of the commercial forest area in 1974.

Timber Volume

Volume of growing stock on commercial forest land totaled 1.1 billion cubic feet in 1974, down 22 percent from the 1.3 billion in 1954.

Volume in sawtimber trees was 3.5 billion board feet, a 30 percent drop from the 5.0 billion in 1954.

Growing-stock volume was highest in the Southeastern and Northeastern Units, each with 44 percent of the State's total.

Hardwoods, primarily oaks, accounted for virtually all of the growing-stock volume.

Average volume per acre of growing stock in 1974 was 723 cubic feet, compared with 587 cubic feet in 1954.

Volume in nongrowing-stock trees, chiefly in rough trees, amounted to an additional 308 million cubic feet in 1974.

Black walnut growing-stock volume fell 38 percent between 1954 and 1974 from 51.5 to 31.8 million cubic feet.

Growing-stock inventory is projected to decline from 1,055 million cubic feet in 1974 to 932 million in 2004, assuming a low level of timber removals, or to 774 million, assuming a high level of timber removals.

Stand Characteristics

Net annual growth on growing-stock trees tot[a]l[ed] 41 million cubic feet in 1973 (3.9 percent of invento[ry])

Mortality of growing-stock trees amounted [to] million cubic feet in 1973 (0.7 percent of invento[ry])

Seventy-seven percent of the commercial fore[st] is capable of growing trees 50 feet and taller at age 0, but only 25 percent of the area is capable of growing trees 70 feet and taller at the same age.

Three-fourths of the State's commercial stands were poorly-stocked or nonstocked with growing-stock trees.

Stands were about equally divided by area in 0-year age classes up to age 90.

Timber Use

Sixty-five primary wood-using plants were operating in 1972 in Iowa—60 were sawmills. In 1952 more than 1,000 sawmills operated in the State.

Output of roundwood products in 1972 was 2.9 million cubic feet compared with 36.6 million in 1953. In 1972 fuelwood accounted for the largest portion of roundwood products output—9.8 million cubic feet.

Iowa's 60 active sawmills produced 56 million board feet of lumber in 1972. Since 1941, production has ranged between 43 and 91 million board feet annually.

Pulpwood production amounted to 55 thousand cords in 1972—24 thousand cords from plant byproducts alone.

Growing-stock removals in 1973 were 50.3 million cubic feet.

Removals of growing stock are projected to drop to 38.4 million cubic feet in 2003, assuming a low level of removals, or to 44.3 million cubic feet, assuming a high level of removals.

Management Opportunities

Sixty-nine percent of the commercial area gross stands that require no treatment between 1974 and 1984.

Fifteen percent of the area does not contain a anageable stand because of the paucity of stock-g, suggesting stand conversion or regeneration eatments.

Fourteen percent of the area is composed of stands hose age and site index indicate they are ready for arvest or will be within the next decade.

Only 2 percent of the area is in immature ad overstocked stands where thinning would be ppropriate.

Nontimber Resources

Total attendance at Iowa's 71 State Parks in 1974 as 12.1 million people, 433 thousand of whom were mpers.

In 1974, Iowans purchased 329 thousand resident fishing licenses, 176 thousand resident hunting licenses, and 147 thousand combination licenses.

In 1974, 307 thousand hunters bagged 1.7 million pheasants in Iowa, making it the number one game species in the State—both in terms of number of hunters and in number of birds taken.

Of the 238 million gallons of water consumed each day in Iowa during 1970, 150 million gallons were for rural use—primarily for livestock.

IOWA'S FOREST RESOURCES, 1974

John S. Spencer, Jr., *Principal Resource Analyst,*
and **Pamela J. Jakes,** *Associate Resource Analyst*

TIMBER RESOURCE TRENDS

Known worldwide for its prolific yields of corn, Iowa is much less well-known as a grower of trees. Yet in 1974, 1,561 thousand acres of forest land existed in the State, which amounts to 4 percent of its total land area (fig. 1). This was down 34 percent from the 2,348 thousand acres in 1954.[1]

Figure 1.—*Forest land in Iowa is often interspersed with agricultural land. (Photo courtesy of Iowa Conservation Commission.)*

[1]*Published 1954 figures shown in "The forest resources of Iowa", Central States Forest Experiment Station, Forest Survey Release 22, March 1959, have been adjusted to be comparable with 1974 data because an estimated 298.2 thousand acres of land classed as commercial forest in 1954 would have been classed as wooded pasture by 1974 standards. This estimate was made by assuming the ratio of wooded pasture to commercial forest land was constant during both surveys. Published 1954 unproductive forest area (none) was adjusted to equal the 1974 unproductive area (26.7 thousand acres) because most of the 1974 field plots classed as unproductive forest were judged by the field crew to have been unproductive forest in 1954 also.*

Commercial Forest Area Plunges

Commercial forest land, which accounted for most of the forest land, plummeted from 2,297 thousand acres in 1954 to 1,459 thousand acres in 1974, a 36 percent decline. Much of this loss was due to the conversion of commercial forest to pasture and other agricultural land.

The decline in forest land has caused concern among natural resource managers in the State. As the commercial forest land base declines, total wood production will also decline unless management on the remaining forest land intensifies, thereby increasing the volume of wood produced per acre. A declining forest land base may also portend a decline in forest wildlife populations. Iowa wildlife requiring forest habitat include such popular game species as grey squirrel, white-tail deer, ruffed grouse, and wild turkey. Forest land is also valuable as a recreation resource, providing settings for picnicking, hiking, cross-country skiing, and snowmobiling.

Iowa's commercial forest land is concentrated in the eastern half of the State—the Southeastern (659 thousand acres) and Northeastern (584 thousand acres) Survey Units contain 85 percent of the commercial forest area (figs. 2 and 3). The Western Survey Unit, Iowa's largest with 43 percent of the State's land area, contains only 15 percent of the commercial forest area (215 thousand acres).

It is impossible to compare commercial forest area by unit between surveys because unit boundaries have changed and 1954 commercial forest area by county is unavailable. However, all units probably lost commercial forest land between surveys.

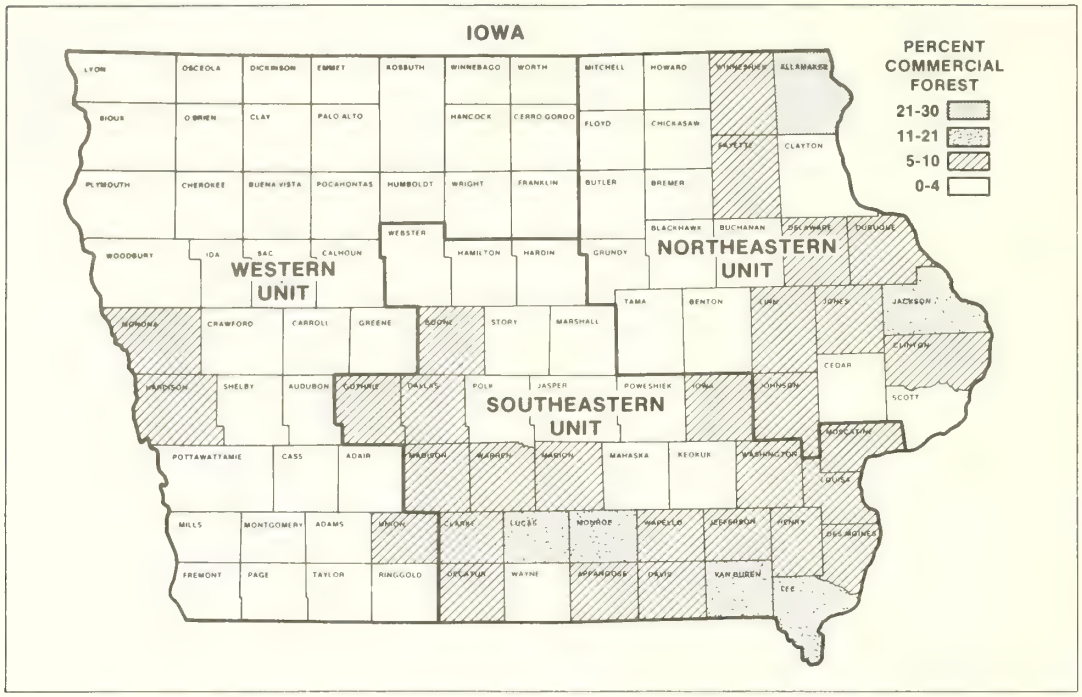


Figure 2.—*Commercial forest area as a percent of land area, by county, Iowa, 1974.*

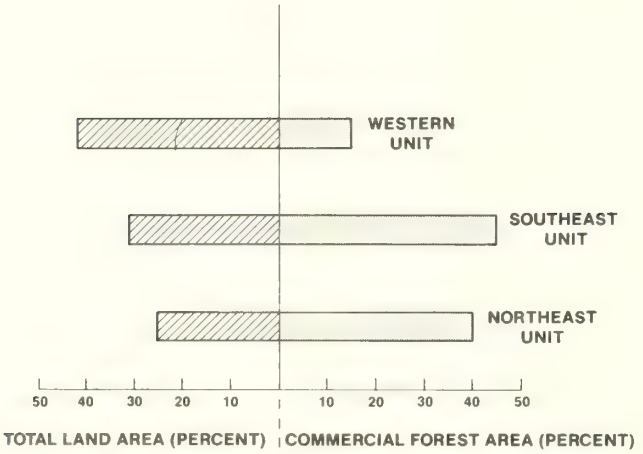


Figure 3.—*Distribution of Iowa's total land area and commercial forest area among Survey Units, Iowa, 1974.*

Topography Influences Forest Types

The surface features and landforms of commercial forest land can help determine the forest type that will occur on a site as well as the quantity and quality of timber produced. The frequency of flooding, availability of water, soil depth, nutrient movement, and micro-climate of a site are affected by topographic features.

More than one-third of Iowa's commercial forest is on level ground or on the lower one-fourth of hillsides. Most of this land is in river bottoms and on streambanks. Cottonwood and elm-ash-cottonwood types commonly occur on these sites.

An additional one-fourth of the State's commercial forest land occurs between the lower and middle portions of hillsides. The "cove effect" is a common phenomenon of the two lower topographic areas. Surrounded by protective hillsides, the micro-climate of a small valley or "cove" is relatively moist and cool. Water in the valley bottom and lower slopes is in good supply because of runoff from the higher slopes. Nutrients from the upper slopes wash down and pool in the valleys. These processes lead to deeper, richer soils with better moisture regimes in coves than on surrounding lands. The ideal growing conditions found in coves make them some of the highest quality forest sites in the State.

The distribution of acreage among topographic classes differs greatly by forest type (table 1). The eastern redcedar-hardwood, white oak-red oak-hickory, white oak, and bur oak forest types are concentrated on the upper half of slopes, but almost all of the elm-ash-cottonwood and cottonwood forest types are found on the lower one-fourth of slopes.

One-Fourth of Commercial Forest is on Good Sites

Measures of site quality describe the productivity of a site for timber production. Information regarding site quality is often required when making management decisions. If stocking levels are similar, higher quality sites will produce more wood volume per acre in a given amount of time than low quality sites. It is also common for higher quality sites to produce higher quality timber.

Two measures of site quality are commonly used—site index and site class. Site index values indicate the productivity of a site in terms of the total height reached by dominant and codominant trees at 50 years of age. Site index values vary among tree species—a site index of 40 (the dominant and codominant trees obtain a height of 40 feet in 50 years) is considered a good site for eastern redcedar but a low site for white oak. The following tabulation shows an

Table 1.—*Area of commercial forest land by forest type and topographic class, Iowa, 1974*
(In thousand acres)

Forest type	All Classes	Topographic class			
		Upper ¼ of slope	Upper mid-¼ of slope	Lower mid-¼ of slope	Lower ¼ of slope
Eastern redcedar-hardwood	34.9	9.0	17.4	—	8.5
White oak-red oak-hickory	514.8	107.9	180.7	157.7	68.5
White oak	150.1	31.8	65.4	40.0	12.9
Bur oak	148.7	16.4	69.1	41.0	22.2
Elm-ash-cottonwood	404.1	21.0	8.4	33.0	341.7
Cottonwood	12.3	—	—	—	12.3
Hard maple-basswood	143.6	24.7	46.3	56.3	16.3
Aspen	7.8	2.6	—	5.2	—
Nonstocked	42.4	12.2	10.3	—	19.9
All forest types	1,458.7	225.6	397.6	333.2	502.3

average site index range for the Midwest and the area of Iowa's commercial forest in each class.

Site index range	Description	Area of commercial forest in Iowa (Thousand acres)
55 or less	low site	550.8
56-70	average site	545.4
more than 70	high site	362.5
	TOTAL	1,458.7

Therefore, about one-quarter of Iowa's commercial forest land is classified as high site. The remaining acreage is divided equally between average and low sites.

Site classes stratify land in terms of its inherent capacity to grow crops of industrial wood. Site classes indicate the annual volume of growth per acre of fully stocked natural stands at culmination of mean annual increment. In Iowa, commercial forest land is divided among the following site classes:

Site class (Cu. ft./ac./yr.)	Area (Thousand acres)
225+	3.4
165-225	—
120-165	37.3
85-120	115.1
50-85	344.9
less than 50	958.0
TOTAL	1,458.7

Both site index and site class measure a site's capacity to grow trees. They do not directly assess a site's capacity for producing nontimber forest resources.

Oak Types Dominate the Commercial Forest

Of the eight forest types in Iowa, the 3 oak types (white oak-red oak-hickory, white oak, and bur oak) accounted for 56 percent of the total commercial forest area—814 thousand acres (fig. 4). In 1954 the oaks were divided into only two forest types (oak-hickory and bur oak) and comprised 48 percent of the State's commercial forest (fig. 5).

The elm-ash-cottonwood type grew on 28 percent of the commercial forest (404 thousand acres). This type declined precipitately since the 1954 survey when it occupied 47 percent of the commercial area (1,219 thousand acres). Some of this type, which generally occupies fertile lowland sites, probably was converted to agricultural uses between surveys. Dutch elm disease also killed many of the elms in this forest type, prompting some stands to be reclassified as another type in 1974.

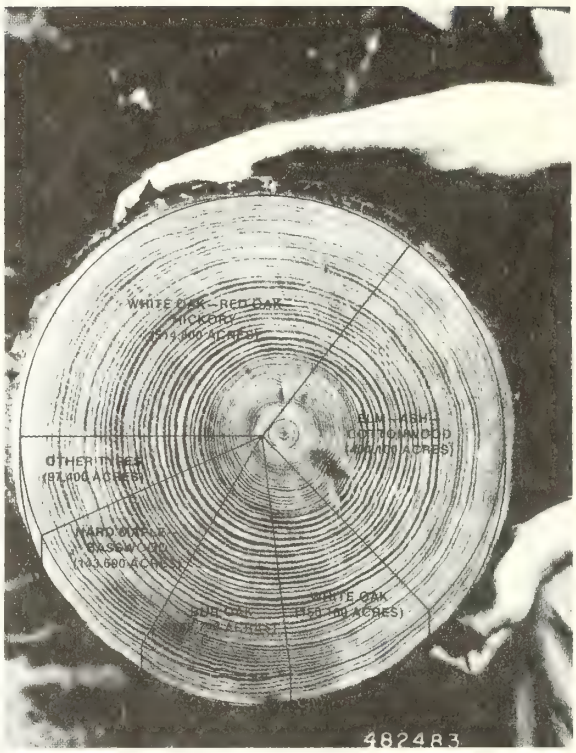


Figure 4.—*Area of commercial forest land by propo- tion in each forest type, Iowa, 1974.*

Figure 5.—*The area of land in oak forest types, li this white oak stand, decreased by approximately 3 percent between 1954 and 1974; however, the pr portion of the total commercial area occupied b oaks increased during the same period. (Photo cou tesy of Iowa Conservation Commission.)*

Highly-prized black walnut was an importa component of some of Iowa's forest types and is ofte favored in timber stand improvement treatments. I 1972 black walnut composed 47 percent of the tot

veneer log and bolt production in the State. In the elm-ash-cottonwood type, State foresters have observed that when elm is eliminated from stands by disease, black walnut often moves in to replace it.

Some Oak Stands Are Over Rotation Age

In general, a forest divided equally between stand age classes is desirable in order to yield an even flow of timber products. A mix of age classes is also desirable to maintain diversity in forest wildlife populations and to provide esthetic enjoyment of the forest.

The stand-age distribution in Iowa varies by forest type, but in general, the acreage is fairly evenly distributed in age classes less than 90 years (fig 6). However, approximately 209 thousand acres of commercial forest land contain stands at or near rotation age. Rotation age is the recommended stand age for harvest according to management criteria specified in the treatment opportunities section of this report (see table 4).

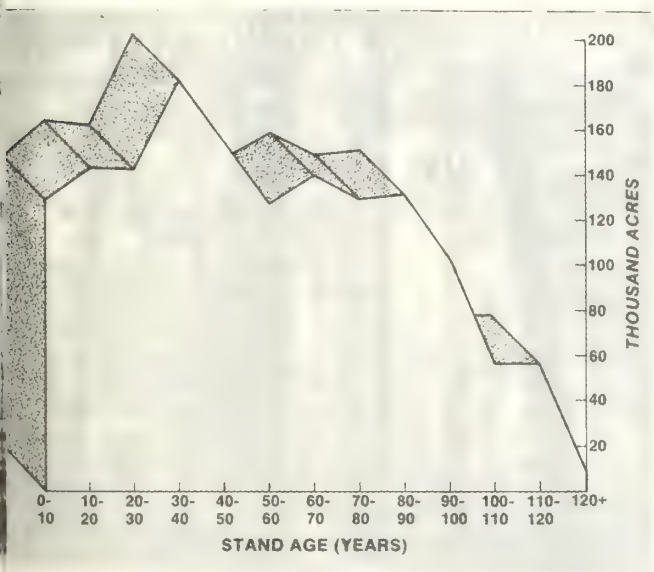


Figure 6.—*Area of commercial forest land by stand-age class, Iowa, 1974.*

Sawtimber Stands Make Up Over Half the Area

Sawtimber stands accounted for 54 percent of the commercial area (781 thousand acres). The majority of these stands were in elm-ash-cottonwood and white oak-red oak-hickory types. Poletimber stands grew on 24 percent of the area (357 thousand acres) and sapling and seedling stands on 19 percent of the forest (278 thousand acres). Nonstocked areas accounted for 3 percent of Iowa's commercial forest (42 thousand acres).

Stocking Needs to be Improved

Three-fourths of the State's commercial stands were 60 percent or less stocked with trees, putting this land in the poorly-stocked or nonstocked classes. All of the sapling and seedling stands in the State fall into these classes, suggesting a problem with regeneration. Much of the poor stocking is the result of heavy grazing in timber stands, which continues to be a major problem.

Regardless of stocking, more than half (51 percent) of the trees in Iowa were rough or rotten. The percentage is higher in the smallest and largest diameter classes—63 percent in the 2-inch diameter class and 54 percent in the greater than 29-inch diameter class (fig. 7).

Figure 7.—*Rotten cull trees take up valuable growing space and may not yield high value timber products. However, they do provide shelter for some birds and animals. (Photo courtesy of Iowa Conservation Commission.)*

Farmers Own Bulk of Commercial Forest

As shown below, farmers own two-thirds of the State's commercial forest land (987 thousand acres):

Owner	Commercial Forest Area 1974 (Thousand acres)
PUBLIC:	
Federal:	
National forest	0.0
Other federal	55.2
State	51.3
County and municipal	4.7
PRIVATE:	
Farmer	987.0
Forest industry	16.7
Miscellaneous	343.8
Total	1,458.7

Farmer-owned land can be characterized as small holdings of less than 100 acres. Sawtimber stands of white oak-red oak-hickory and elm-ash-cottonwood frequently occur on farmer-owned land.

Miscellaneous private owners control the second largest block of commercial forest land in Iowa. Almost one-half of the parcels of commercial forest land in this ownership class are less than 50 acres in size (table 2). All of the large holdings in the miscellaneous private category are owned by corporations. Most of the stands are composed of sawtimber-size trees with white oak-red oak-hickory the most common forest type.

The 111 thousand acres of public-owned comme cial forest land are principally made up of larg holdings. Public land is usually occupied by sawtin ber-size stands, and elm-ash-cottonwood is the majo forest type. The productive potential of public con mercial forest land is 45 percent higher than th State's average.

Iowa's 17 thousand acres of forest industry land ar located entirely in the Northeastern and Southeas ern Forest Survey Units. Most (86 percent) of th land is in holdings larger than 500 acres. White oak red oak-hickory occurs frequently in this ownershi class.

Inventory Volume Drops 22 Percent

The volume of growing stock on commercial fores land dropped from 1.3 billion cubic feet in 1954 to 1. billion in 1974, a 22 percent decline. Hardwood which comprised almost all of the volume, accounte for the decline. Softwoods, representing a miniscul 0.5 percent of the total 1974 volume, gained betwee surveys as seen in the following tabulation:

	1954	1974
	—(million cubic feet)—	
Softwoods	3.7	5.
Hardwoods	1,345.1	1,048.
Total	1,348.8	1,054.

This volume decline is directly related to the larg loss of commercial forest area described earlier.

Table 2.—*Area of commercial forest land by owner class and size of holding, Iowa, 1974*
(In thousand acres)

	Size of holding (acres)						
Owner class	Total	0-50	50-100	100-500	500-2500	2500-5000	5000
Public	111.2	—	—	—	5.9	8.4	96.
Private							
Forest industry	16.7	0.1	0.1	2.2	1.8	2.5	10.
Farmer	987.0	368.3	361.3	255.3	2.1	—	–
Miscellaneous:							
Individual	304.9	143.4	94.3	51.5	15.7	—	–
Corporation	38.9	3.2	3.8	6.6	8.4	5.9	11.
TOTAL	1,458.7	515.0	459.5	315.6	33.9	16.8	117.

Growing-stock volumes are nearly equal in the Northeastern Unit (460 million cubic feet) and the Southeastern Unit (462 million) but are considerably smaller in the Western Unit (133 million).

Five of the six counties with the greatest volume of growing stock in the State are in the Northeastern Unit (fig. 8): Allamakee (85 million cubic feet), Clayton (67 million cubic feet), Jackson (43 million cubic feet), Winneshiek (32 million cubic feet), and Dubuque (28 million cubic feet). The other county in the top six is Lee County (33 million cubic feet) in the Southeastern Unit.

Volumes per acre averaged 723 cubic feet over the entire State in 1974 compared with 587 cubic feet in 1954. This increase occurred because some of the commercial forest land lost between surveys was of low productivity, forest management has improved, and some undesirable forest practices may be moderating—such as the heavy grazing found on 27 percent of the forest land during the 1954 survey that left no young growth in the stands. The highest average volume per acre is in the Northeastern Unit—787 cubic feet.

Hardwoods, Chiefly Oaks, Account for Most Volume

Hardwoods account for virtually all of the 1.1 billion cubic feet of growing-stock volume in 1974. Softwoods, chiefly eastern redcedar, represent a negligible but expanding part of the resource. The oaks dominate with 403 million cubic feet, 38 percent of the hardwood volume. White oak (148 million) and northern red oak (126 million) account for the bulk of the oak volume. Soft maple (110 million cubic feet), elm (95 million), cottonwood (92 million), and hickory (79 million) are other species with large volumes.

Significant increases in volume between surveys were made by the hickories (27 percent gain) and white oak (15 percent gain). Substantial declines were registered for other white oaks[2] (22 percent loss), cottonwood (22 percent loss), basswood (29 percent loss), and other red oaks (32 percent loss). The volume of highly sought-after black walnut dropped 38 percent, and elm volume plummeted 67 percent—the result of Dutch elm disease.

[2]*Other white oaks include swamp white, bur, chinkapin, overcup, and post oaks. See Principal Tree Species in Iowa in Appendix for composition of other species groups.*

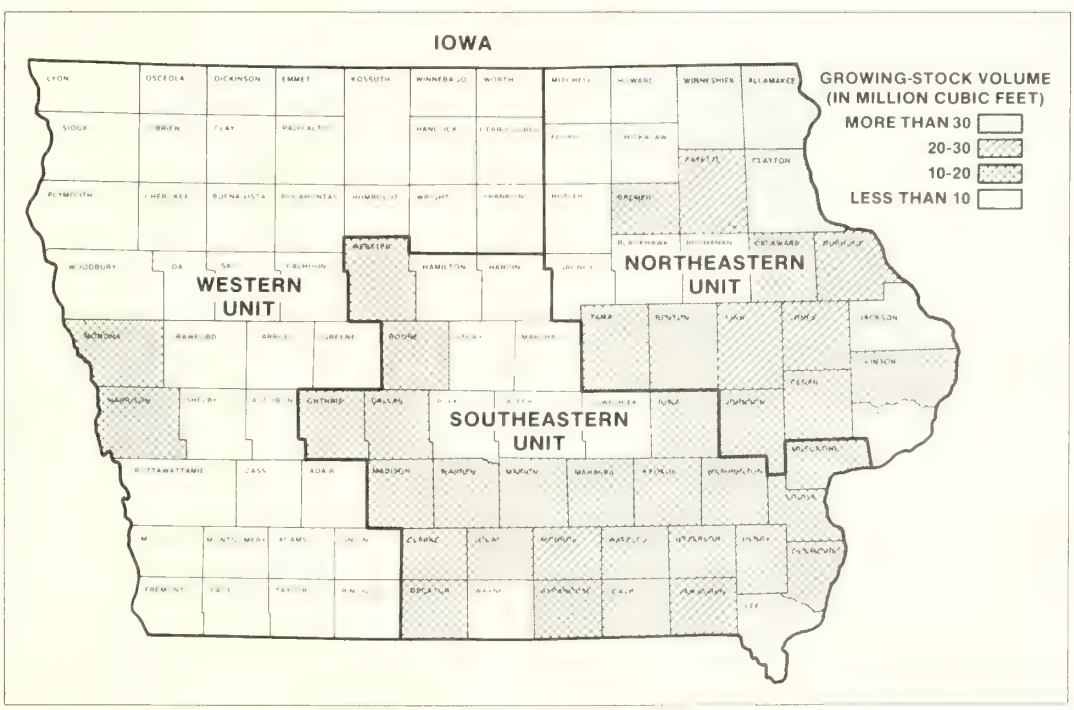


Figure 8.—*Growing-stock volume in Iowa counties, 1974.*

Growing-stock volumes increased in the 6- and 8-inch diameter classes but dropped in all other classes (fig. 9). The drop was most pronounced in the largest diameters. Volumes in the 20-inch and larger class fell 42 percent between surveys, and volume in the 18-inch class sank 35 percent because more of these trees were removed from the inventory than were replaced by ingrowth from smaller diameter classes. Fifty-one percent of the growing-stock volume was in trees 15 inches d.b.h. and larger in 1954, compared with only 41 percent in 1974. The obvious implications are that large diameter trees will be even fewer in the near future and that forest industries will have to adjust to a somewhat smaller average tree size.

Private Nonindustrial Owners Account for 88 Percent of Volume

Farmers own 63 percent of the growing-stock volume, although they own 68 percent of the commercial forest area. Other private nonindustrial owners account for 25 percent of the volume (24 percent of commercial area). Public agencies own 11 percent of the volume (7 percent of area) and forest industries own 1 percent of the volume (1 percent of area). All of the softwood volume is owned by farmers (88 percent) and other private nonindustrial parties (12 percent).

One-third of the growing-stock volume is in specie of the white oak-red oak-hickory forest type and one third is in species of the elm-ash-cottonwood type The other one-third of the volume is scattered amon the remaining forest types.

In addition to the 1,054.7 million cubic feet i growing-stock trees discussed heretofore, the inven tory includes 308.4 million cubic feet of timber i trees failing to qualify as growing stock because c species, poor form, or internal decay. Rough and rot ten trees account for 73 percent of this largely unuse nongrowing-stock volume. Short-log trees (27 per cent) and salvable dead trees (less than 1 percent make up the rest of this volume. Although unsuite for many high-value timber products, nongrowing stock trees are used for firewood and other product and are a potential source of additional wood fibe when expanded markets are developed.

Black Walnut Volume Drops 38 Percent Between Surveys

Black walnut, a species of particular importance i Iowa because of its' high value, intense demand, an shrinking supply, experienced a sharp drop in grow ing-stock volume between surveys. Walnut volum on commercial forest land in 1954 was 51.5 millio cubic feet but in 1974 it was only 31.8 million (fig. 10

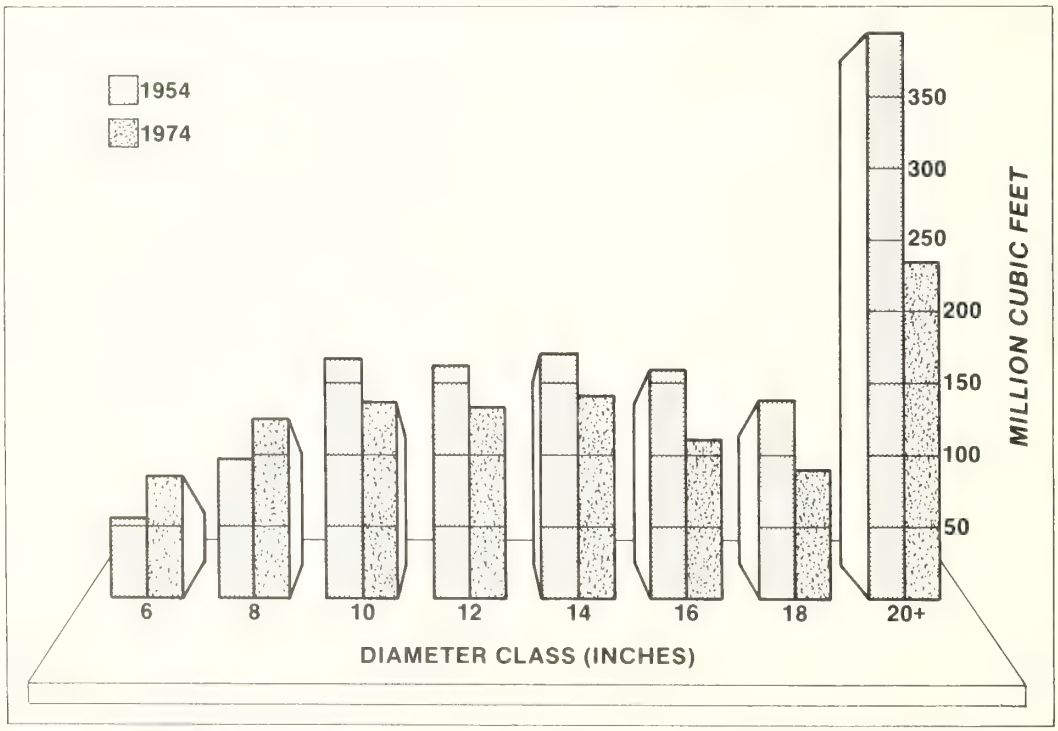
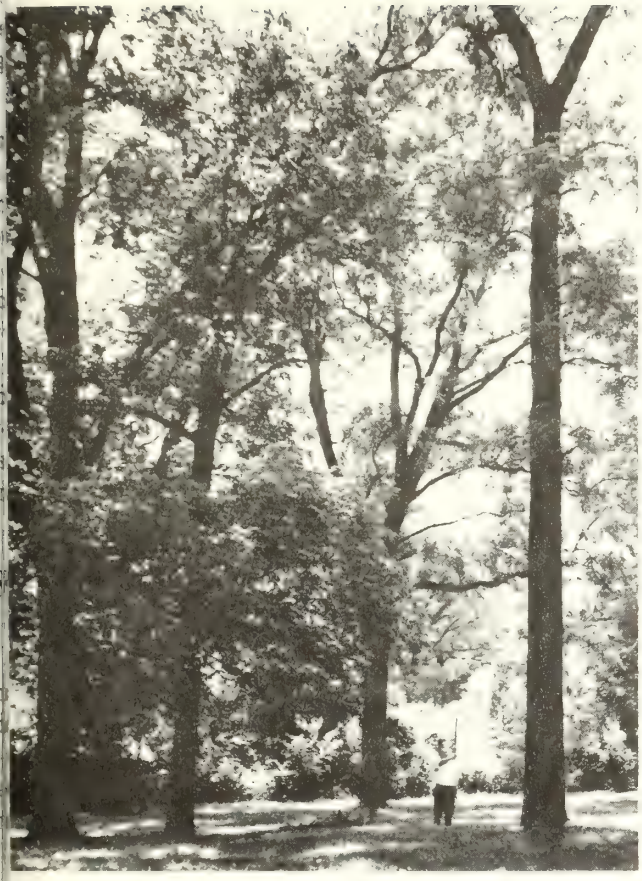


Figure 9.—*Volume of growing stock by diameter class, Iowa, 1954 and 1974.*



igure 10.—*The volume of black walnut, held in esteem throughout the world by those who use and appreciate fine hardwoods, is declining in Iowa. Walnut volume on commercial forest land fell 38 percent between 1954 and 1974. (Photo courtesy of Iowa Conservation Commission.)*

Black walnut nongrowing-stock trees on commer-al forest land account for an additional 6.3 million ıbic feet.

Another 6.0 million cubic feet of black walnut rows on nonforest land in the State as shown in the llowing tabulation:

ee class	Black walnut live tree volume *(Thousand cubic feet)*
n commercial forest land:	
Growing-stock trees	31,823
Rough and rotten trees	3,984
Short-log trees	2,313
All tree classes	38,120
n nonforest land:	
Growing-stock trees	3,205
Rough and rotten trees	2,414
Short-log trees	366
l tree classes	5,985

Much of the black walnut volume, especially that on nonforest land, is in highly scattered trees. Trees may be found singly in pastures, fields, and along fence rows.

Sawtimber Volume Down One-Third

The inventory of growing stock includes 3.5 billion board feet of sawtimber, down 30 percent from 1954. This is a sharper decline than that for total growing-stock inventory—22 percent—and is probably caused by heavier cutting in the larger diameter classes. As in the case of growing-stock inventory, softwood sawtimber volume increased between surveys:

	1954	1974
	—(Million board feet)—	
Softwoods	6	11
Hardwoods	4,946	3,475
Total	4,952	3,486

The largest sawtimber volumes are generally found in the same counties that the largest growing-stock volumes are found. Sixty-one percent of the sawtimber volume was in trees 15 inches d.b.h. and larger in 1974, compared to 70 percent in 1954. Average volume per acre in 1974 was 2,390 board feet, compared to 2,156 in 1954. Fifty-seven percent of the sawtimber volume in 1974 was in the two log grade classes at the low end of the four class quality scale.

In 1974, 88 million board feet of black walnut in sawtimber trees grew on commercial forest land in the State—down 100 million board feet from 1954. Additionally in 1974, 7 million board feet of walnut in short-log trees grew on commercial forest land. Also, 16 million board feet of walnut in sawtimber trees and 1 million in short-log trees grew on nonforest land in 1974.

Growth Rate is 3.9 Percent

Net annual growth of growing-stock trees in Iowa in 1973 totaled 41 million cubic feet, or 28 cubic feet/acre.

The 1973 growth rate was 3.9 percent of inventory. The growth rate for softwoods (4.2 percent) was slightly higher than that for hardwoods (3.9 percent), and the growth rate on public land (5.6 percent) was slightly higher than that on other land (3.7 percent).

The white oaks produce the largest volume of growth (16 percent of the total growth) followed by soft maple (15 percent), red oak (12 percent), and cottonwood (11 percent).

Net annual growth of sawtimber in Iowa was 80 million board feet in 1973, 2.3 percent of inventory. Select white oaks, cottonwood, and soft maple accounted for more than 66 percent of the total volume.

Mortality of growing-stock trees amounted to 7 million cubic feet in 1973, or 0.7 percent of inventory. The mortality rate for softwoods (0.9 percent) was slightly higher than for hardwoods (0.7 percent). Rate of mortality was significantly lower on public (0.2 percent) than on private-owned commercial forest (0.7 percent).

Disease caused 87 percent of the mortality volume in the State. Dutch elm disease was one of the most active—elm mortality accounted for 62 percent of the total mortality volume.

Annual sawtimber mortality was 26 million board feet in 1973, 0.7 percent of inventory.

Adding the volume of net annual growth (41 million cubic feet) to the volume of mortality (7 million) provides an estimate of gross growth for the State (48 million). Net growth was, therefore, 86 percent of gross growth (fig. 11).

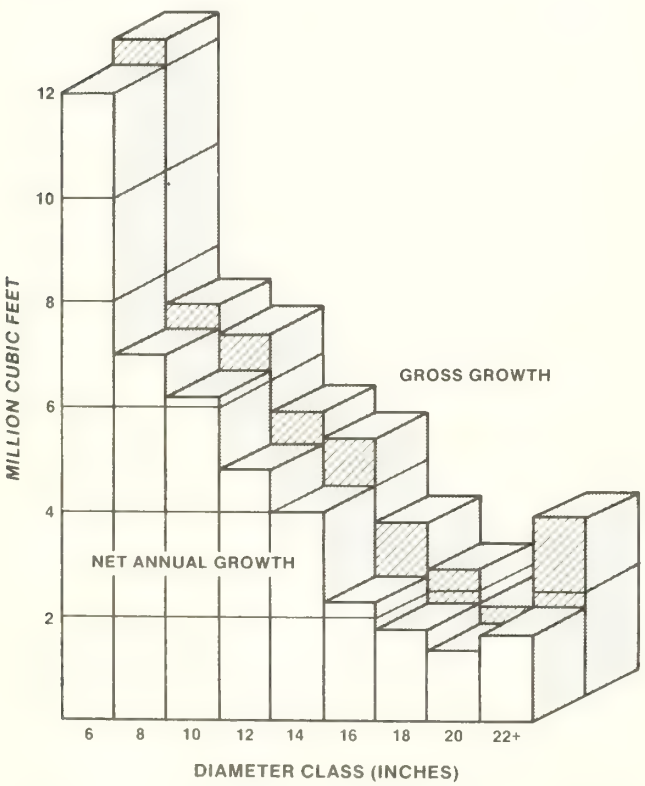


Figure 11.—*Gross annual growth and net annual growth of growing stock by 2-inch diameter class, Iowa, 1973. The difference between gross annual growth and net annual growth is annual mortality.*

Potential Growth is 51 Cubic Fee Per Acre

A rough estimate of the potential net annu growth (or productive potential) of Iowa's commerci forests can be made using site class data from th Iowa survey. As mentioned earlier, site class valu indicate the annual volume of growth per acre fully-stocked natural stands at culmination of mea annual increment. By multiplying the area in a si class by the midpoint of the growth range in ea class, an estimate of the State's productive potenti can be obtained (table 3). This is a simplistic measu of potential growth because it does not take in account the present distribution of age classes or th obvious differences in growth among them. The r sults, therefore, probably overestimate the tru potential. Spurr and Vaux took 90 percent of an est mate of potential growth for the Nation as bein realistic.[3] A recent study of the aspen type in Wisco sin suggests that potential growth is 52 perce higher than current growth.[4]

Table 3.—*Estimation of potential net annual grow on commercial forest land, Iowa, 1973*

Site class Cubic ft./ acre/year	Area of commercial forest land	Potential[1] net growth per acre	Total potent net grow
	Thousand acres	*Cubic ft./ acre/year*	*Thousand cu feet/year*
225+	3.4	235.0	799
225-165	—	195.0	
165-120	37.3	142.5	5,315
120-85	115.1	102.5	11,797
85-50	344.9	67.5	23,280
20-50	958.0	35.0	33,530
TOTAL	1,458.7	—	74,722

[1]Midpoint of site class interval.

[3]*Spurr, Stephen H., and Henry J. Vaux. 197 Timber: biological and economic potential. Scien 191 (4228):751-756.*

[4]*Lundgren, Allen L., and Jerold T. Hahn. 197 The extent and characteristics of low productiv aspen areas in Wisconsin. U.S. Department of Ag culture Forest Service, General Technical Rep NC-45, 24 p. U.S. Department of Agriculture For Service, North Central Forest Experiment Station, Paul, Minnesota.*

Using this method, the potential net annual growth or Iowa is 75 million cubic feet, or 51 cubic feet per cre. The productive potential of publicly owned forsts (74 cubic feet per acre) is higher than the potential f miscellaneous private (51 cubic feet per acre), armer (49 cubic feet per acre), or forest industry (48 cubic feet per acre) owned forests. In the Northeastern Survey Unit the productive potential is lightly higher than in the Southeastern and Western Units. Assumptions behind this estimate of potential et growth include: (1) all commercial forest land is ully stocked; (2) age classes are evenly distributed; (3) o intermediate cuttings of growing-stock trees occur rior to final harvest; and (4) harvest occurs at culmiation of mean annual increment.

Potential growth could be further increased if anagement were expanded to include more intenive cultural operations such as weeding, thinning, lanting of genetically superior stock, or fertilizing.

The percent of potential net growth that occurs in ne higher site classes is greater than the percent of ommercial area in these site classes (fig. 12). The everse is true for the poorer site classes. This dramazes the economic truism that if management costs ary little with changes in site quality, returns from nvestments in forest management will be greatest n lands with the highest site quality.

Timber Removals Rate is 5.4 Percent

Timber removals from growing stock in 1973 toaled 50.3 million cubic feet but the net annual rowth was only 41.3 million cubic feet. Prolonged nbalance of removals over growth, obviously, leads a declining inventory. It is impossible to say how ng removals have exceeded growth because the 954 survey of Iowa made no estimate of "other" emovals.[5] But the 30-year projections of Iowa's timer resource discussed later assume that removals ill exceed growth during the entire period.

Only 26 percent of total removals (13.2 million ubic feet) was utilized for roundwood products ig.13), 71 percent (35.4 million cubic feet) was ther" removals, and the remaining 3 percent (1.7 illion cubic feet) was logging residues.

[5] *"Other" removals are trees removed but not utized for products or trees left standing but "removed" om the commercial land classification by land-use ange.*

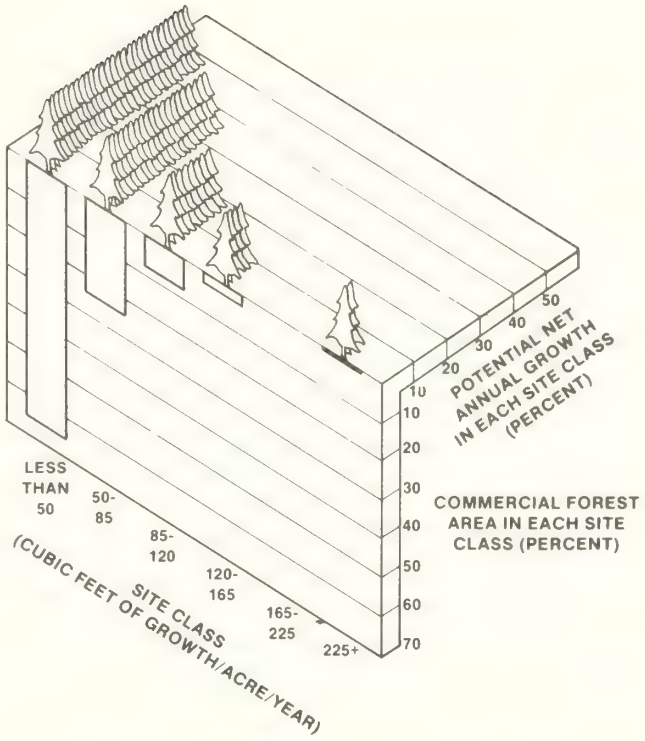


Figure 12.—*Distribution of commercial forest area and potential net annual growth by site class, Iowa, 1973.*

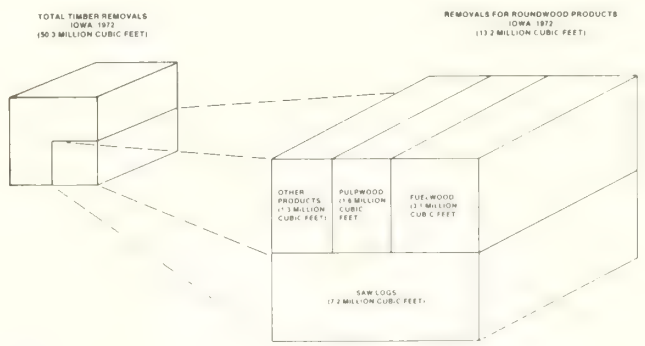

TOTAL TIMBER REMOVALS IOWA 1972 (50 3 MILLION CUBIC FEET)
REMOVALS FOR ROUNDWOOD PRODUCTS IOWA 1972 (13 2 MILLION CUBIC FEET)
OTHER PRODUCTS (1 3 MILLION CUBIC FEET)
PULPWOOD (1 8 MILLION CUBIC FEET
FUELWOOD (3 1 MILLION CUBIC FEET
SAW LOGS (7 2 MILLION CUBIC FEET)

Figure 13.—*Growing-stock timber removals and components of roundwood products removals, Iowa, 1973.*

Fifty-four percent of the removals utilized for products was used for saw logs (fig.14). Fuelwood (24 percent) and pulpwood (12 percent) accounted for other large products removals volumes.

Almost all of the total removals volume (99 percent) came from farmer and miscellaneous private-owned land.

Figure 14.—*Red oak saw logs, like this one being skidded to a landing, are used primarily for railroad ties and furniture in Iowa. (Photo courtesy of Iowa Conservation Commission.)*

The oak species made up the largest portion (28 percent) of growing-stock volume removed for products in 1973. Most of the remaining volume was comprised of elm, cottonwood, soft maples, and ash.

Sawtimber removals totaled 163.3 million board feet in 1973. Thirty-eight percent (61.7 million board feet) of the removals was for products, 60 percent (98.7 million board feet) was "other" removals, and 2 percent (2.9 million board feet) was logging residues.

Two-thirds of the sawtimber removals for products was saw logs.

One-fourth of the sawtimber volume removed for products was oak. Hard and soft maples, cottonwood, basswood, hickory, and black walnut accounted for one-half of the volume harvested.

TIMBER PRODUCTS OUTPUT

Output of Roundwood Products in 1972 was 22.9 Million Cubic Fee

Total output of timber products from Iowa fores in 1972[6] amounted to 26.4 million cubic feet. Outpu from roundwood made up most of the total, 22.9 mi lion, and plant byproducts contributed the remainir 3.5 million. Roundwood production fell 37 percer from 1953 when it was 36.6 million cubic feet. A dr in fuelwood production from 24.0 million cubic feet 1953 to 9.8 million in 1972 was the major reason f the decline.

Wood-using industries[7] employed 9,200[8] perso in 1972 (4.3 percent of all employees of manufactu ing firms in the State) in 220 establishments. The figures include both primary and secondary man facturing plants. These industries met a payroll $74.0 million in 1972 (3.6 percent of the State tota and made new capital expenditures of $13.4 millic (4.1 percent of State total). The value added to Iowa economy by the manufacture of wood and paper pro ucts was $162.0 million in 1972 (3.4 percent of Sta total).

Four timber products dominate in Iowa (fi 15)—fuelwood (39 percent of total output of timb products), saw logs (34 percent), pulpwood (16 pe cent), and veneer logs (4 percent).

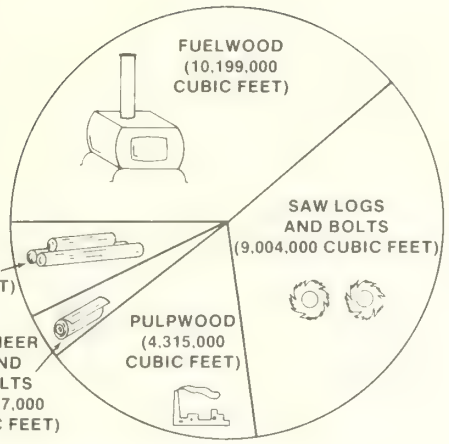
Fuelwood Accounts for Larges Share of Output

The total output of fuelwood in 1972, 10,199 thou sand cubic feet, was greater than that of any oth timber product. Practically all of this was i hardwood species—largely elm and ash. Roundwoo accounted for 96 percent of the total fuelwood outpu (9,796 thousand cubic feet) and plant byproduc made up the remaining 4 percent (403 thousand

[6]*Timber products output information is dated 197 rather than 1974 because the independent study th provided output information was conducted in 1972*

[7]*U.S. Bureau of Census, Standard Industrial Coc (SIC) 24, Lumber and Wood Products; and SIC 2 Paper and Allied Products.*

[8]*1972 Census of Manufactures, MC72(3)-16.*



ure 15.—*Total output of timber products by product, Iowa, 1972.*

o-thirds of the roundwood volume was from non-wing-stock material—cull trees, salvable dead es, noncommercial species, sapling-size trees, and bwood.

uelwood cut from roundwood in 1972 amounted to y 41 percent of the 1953 fuelwood volume. How-r, fuelwood production from roundwood is likely rise significantly in the future, in light of the rent energy crisis.

Sawmills Produced 56 Million Board Feet of Lumber in 1972

The 60 active sawmills in Iowa in 1972 (fig. 16), presenting 92 percent of the primary wood-using nts in the State, received 59.6 million board feet of w logs. This was an increase of 15.2 million board t from saw log receipts in 1969. Other States, marily Missouri, Illinois, and Wisconsin, provided percent of the receipts. Iowa sawmills produced 56 llion board feet of lumber in 1972. Since 1941 the ate's annual lumber production has ranged be-een 43 and 91 million board feet.

Although the number of active sawmills in the ate has declined dramatically since 1953 when ere were approximately 1,000 mills, the average nual lumber production per mill has risen just as amatically (fig. 17).

In 1972 loggers harvested 53.5 million board feet of w logs in Iowa, an increase of 14 percent from 1969. e Northeast Unit provided 57 percent of the saw g volume. Most of the saw logs were sent to Iowa sawmills (50.6 million board feet). Those shipped out-of-State were primarily black walnut and went chiefly to Missouri, Minnesota, and Kansas.

Red oak accounted for more saw log volume harvested (11.1 million board feet) than any other species and was followed by cottonwood (10.8 million), elm (7.8 million), and white oak (6.5 million) (fig. 18). About 80 percent of the saw log volume was produced from growing stock; the remainder was produced from nongrowing stock.

Trend of Pulpwood Production is Up

Iowa pulpwood production in 1972 was 54,618 cords—30,899 cords from roundwood and 23,719 cords from plant byproducts. Total pulpwood production was up considerably from the 3,200 cords reported in 1953 and the 22,461 cords reported in 1961. No plant byproducts were pulped in either 1953 or 1961.

Modifications in pulping and sawmill technology have enabled pulp facilities to utilize plant byproducts, thus increasing the amount of available fiber without increasing harvest levels. Prior to 1962, all pulpwood in Iowa came from roundwood. By 1972, however, 21 percent of the total pulpwood production was from softwoods that came from secondary wood-using plants, such as millwork plants. The hardwood byproducts used as pulpwood were primarily sawmill slabs and edgings.

Other modifications in technology have made it possible to use increasing amounts of hard hardwoods (i.e., oaks, hickories, white ash, green ash, and sugar maple) as pulpwood (fig. 19). The total production of pulpwood from hard hardwoods increased from 4,000 cords in 1956 to 20,837 cords in 1972. During the same period pulpwood production from soft hardwoods (i.e., cottonwood, American elm, basswood, and silver maple) fell from 15,000 to 10,062 cords.

Iowa boasts two pulpmills with a combined pulping capacity of about 230 tons per 24 hours. Both are located along the eastern edge of the State.

Veneer Log Production Declines

Of the 5.2 million board feet of veneer logs produced in Iowa during 1972, only 1.2 million were peeled at the State's two veneer mills. The rest was shipped out-of-State, primarily to mills in Wisconsin (1.5 million board feet), Indiana (0.5 million), and foreign countries (1.2 million).

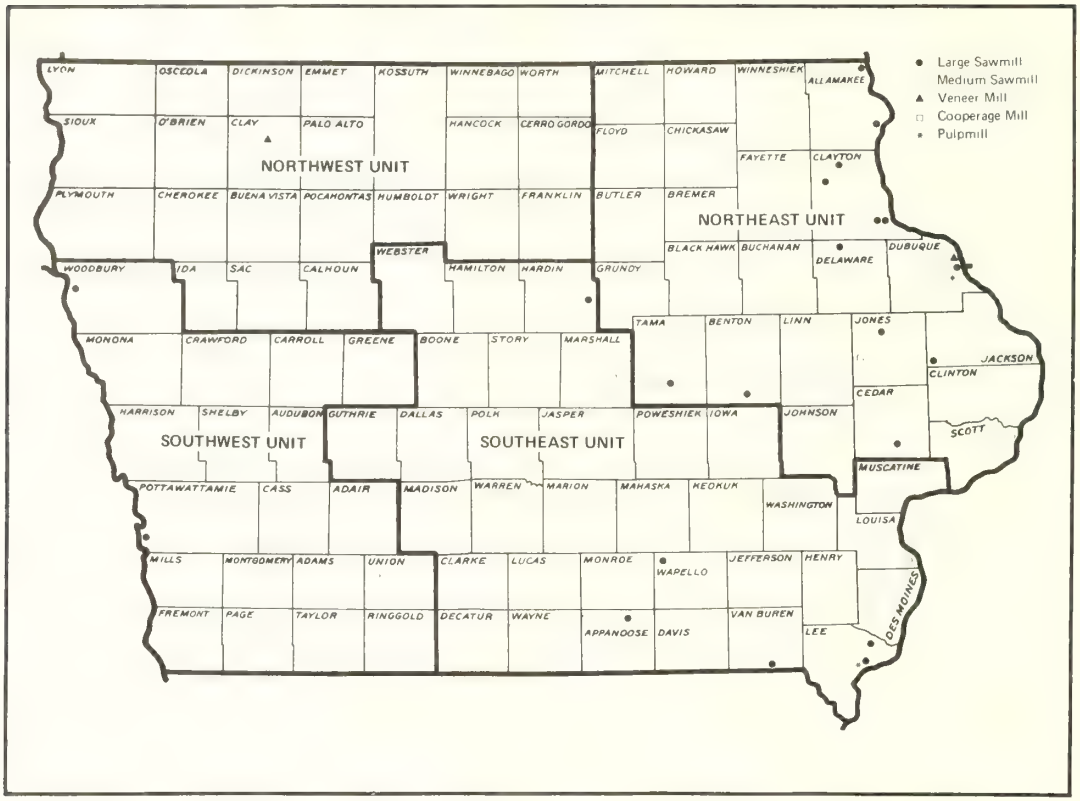


Figure 16.—Primary wood-using plants in Iowa, 1972. Sawmills are classed by volume of lumber produced in 1972: large = more than 1 million board feet; medium = 0.101 to 1.000 million board feet (smaller sawmills not shown).

Figure 17.—*In 1953 the average lumber production per mill was less than 65 thousand board feet but by 1972 it had jumped to 927 thousand board feet. (Photo courtesy of Iowa Conservation Commission.)*

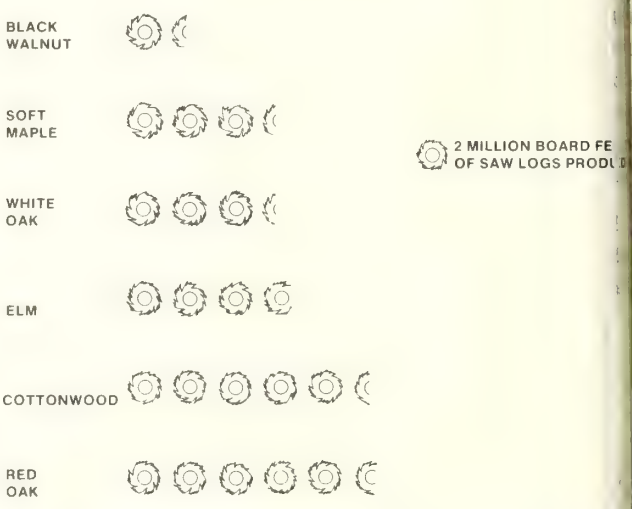
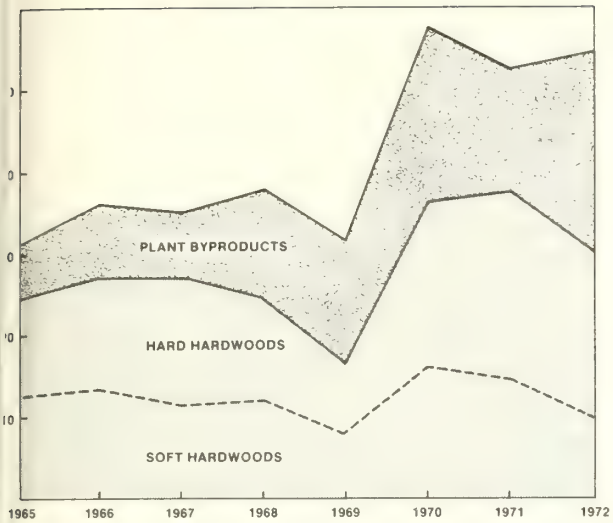


Figure 18.—*Saw log production by major specie Iowa, 1972.*



ure 19.—*Pulpwood production from roundwood y soft hardwoods and hard hardwoods, and from lant products, Iowa, 1965-1972.*

he 1972 harvest of veneer logs (5.2 million board t), which contains the volume of black walnut logs ported overseas, was 42 percent lower than the 0 harvest (8.9 million), which did not include lnut export volume. The volume of veneer logs duced from almost all species has declined during last decade. The percentage decrease in the vol- ne of cottonwood and soft maple veneer logs har- sted has been especially sharp. Black walnut, ich accounted for almost half of the 1972 veneer output, has contributed a generally declining vol- ne harvested during the last decade. A notable ception to the above decline is the harvest of hick- y. Hickory was not used for veneer in Iowa until the d-1960's. By 1972, however, it comprised 11 per- nt of the volume of veneer logs produced.

Fence posts, cooperage logs, mine timbers, farm nbers, mulch, and livestock bedding are also pro- ced in Iowa.

FUTURE TIMBER SUPPLY

A recent projection of national demand for ardwood roundwood shows a near doubling of the 70 consumption of 3.0 billion cubic feet to 5.9 bil- on by 2000.[9] Relative wholesale prices of timber oducts throughout the projection period are as- med to be 15 percent higher for miscellaneous products and fuelwood and 10 percent higher for paper and board than 1970 average prices. This projection, made at a medium level of population and economic growth, was one of three made with different sets of price assumptions.[10] When the excess of projected hardwood imports over exports is subtracted from the projected demand in 2000, the result is a demand on United States forests of 5.6 billion cubic feet.

Projected national supplies of hardwood roundwood are estimated to increase from 2.9 billion cubic feet in 1970 to 7.4 billion in 2000.[11] This is a technical potential assuming no problems with operability or availability and, therefore, may not be realized. The projected supply of hardwood, then, exceeds demand on United States forests in 2000 by 1.8 billion cubic feet. This favorable supply outlook, however, is clouded by problems of timber quality, size, and availability.

Although Iowa's timber resource will not play a big role in affecting the Nation's future timber supply or demand, a comparison of the State's future timber situation with the Nation's is in order. Also, a look at what is likely to happen to Iowa's timber stands in the future under several levels of removals is a useful tool for resource planners and others who are able to modify forest practices.

To this end, two computer-generated projections of the State's timber resource were made. One assumed a continuation of recent levels of timber removals (low removals option), and the other assumed a higher level of removals (high removals option). Both

[9]*U.S.Department of Agriculture, Forest Service. 977. The Nation's renewable resources—an assess- ent, 1975. Forest Resource Report No. 21, 243 p.*

[10]*Other projections were made based on the assumptions that: (1) 1970 wholesale prices of timber products relative to average wholesale prices of all commodities and to most competing materials would remain at 1970 levels, and (2) relative wholesale prices would rise above 1970 trend levels as follows—lumber-1.5 percent per year; plywood, miscellaneous products, and fuelwood-1.0 percent per year; and paper and board-0.5 percent per year.*

[11]*Projections of supply are defined as the amount of timber that would be available for harvesting if: (1) forestry programs continued at 1970 levels, (2) timber removals in the East changed on a straight line basis from actual removals in 1970 to a balance with growth in the year 2000 and thereafter, (3) removals on private land in the West followed trends suggested by recent management and operating practices, and (4) allowable cuts on public land remained at the 1970 level.*

projections were made for all species, rather than separate projections for softwoods and hardwoods, because of the extremely small volume of softwoods. A stand projection technique[12] was used involving input of number of trees, radial growth, mortality rates, and removal rates, all by 2-inch diameter classes, along with assumed total removals by year and assumed ingrowth into the 2-inch d.b.h. class.

Assumptions common to both low and high removals options were: (1) total area of commercial forest land between 1974 and 2004 will decrease from 1,458.7 to 1,251.0 thousand acres, an average annual rate of loss of 0.475 percent; (2) radial growth will decline in relation to the increase of basal area per acre of trees; (3) intensity of forest management will continue at the rate indicated by recent trends; and (4) volume of "other" removals will drop during the period as more trees are utilized that formerly were cut but not used.

Low Removals Option Projection

Under the low removals option, total timber removals are assumed to decrease at an average annual rate of 0.789 percent or 397 thousand cubic feet. Yet growth is projected to be lower than removals throughout the period and to decrease at an average annual rate of 0.331 percent or 137 thousand cubic feet. Therefore, inventory is projected to decline at an average annual rate of 0.389 percent or 4.1 million cubic feet. Total removals are projected to be lower in every year of the period than for the high option, and inventory, growth, and mortality volumes are all projected to decline less rapidly than in the high option.

This projection shows removals declining from 50.3 million cubic feet in 1973 to 38.4 million in 2003 (fig. 20). Removals for the major roundwood products—saw logs, veneer logs, pulpwood, and fuelwood —are assumed to rise during the period, but more of these products are assumed to be recovered from what was formerly "other" removals. The resulting sharp drop in "other" removals translates into a net decline in total removals.

Growth is projected to decline from 41.3 million cubic feet in 1973 to 37.2 million in 2003. Growth and removals begin the projection period with an excess

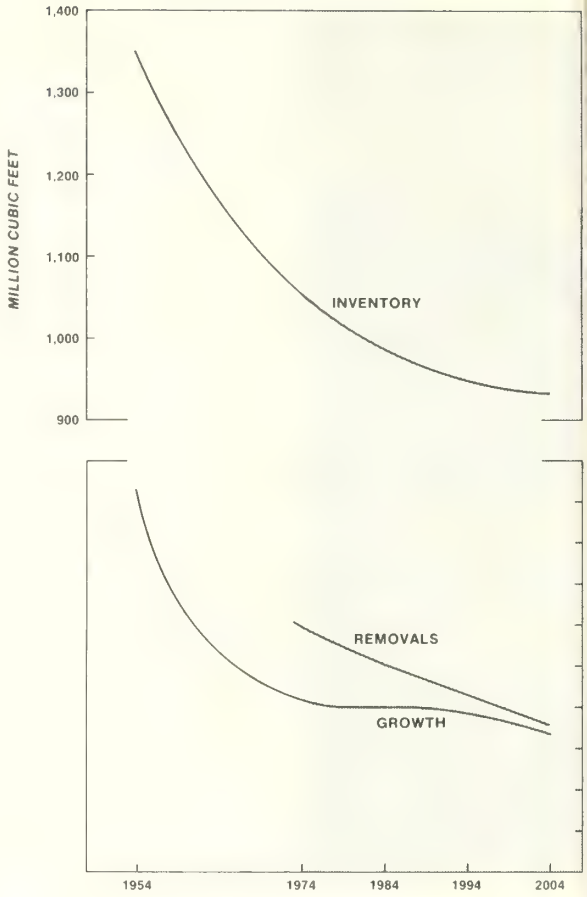


Figure 20.—*Removals, net growth, and inventor[y] growing stock in Iowa, 1954 and 1974, and [re]movals option projections for 1984-2004. Tim[ber] removals information is not available prior to 19[54] and therefore, cannot be graphed. Only timber [data] (which does not include logging residues and ot[her] removals) was published in 1954.*

of removals of 9.0 million cubic feet, but quickly mo[ve] toward each other, ending the period separated by [a] removals excess of only 1.2 million cubic feet.

Inventory is projected to decline from 1,054.7 m[il]lion cubic feet in 1974 to 931.7 million in 2004, a [12] percent drop. The inventory curve moderates i[ts] downward plunge and begins to flatten out as grow[th] and removals converge toward the end of the proje[c]tion period.

High Removals Option Projectio

Under the high removals option, timber remova[ls] are assumed to decrease at an average annual rate [of] 0.398 percent or 200 thousand cubic feet, which

[12] *U.S. Department of Agriculture Forest Service. 1970. TRAS, a computer program for the projection of timber volume. U.S. Department of Agriculture, Agriculture Handbook 377, 24 p.*

about half the rate of decrease of the low removals option. Growth, which continuously trails removals throughout the period, is projected to sink at an average annual rate of 0.694 percent or 287 thousand cubic feet. The growth and removals curves roughly parallel each other for the first 2 decades of the projection period but then begin to diverge during the last decade (fig. 21). The wide imbalance of removals over growth causes inventory to sink at an average annual rate of 0.887 percent or 9.4 million cubic feet.

Removals are projected to dip from 50.3 million cubic feet in 1973 to 44.3 million in 2003, a 12 percent decline. Removals for major roundwood products are assumed to increase during the period and to rise faster than for the low removals option. Some of these products are assumed to be utilized from what was formerly "other" removals, but not as much as for the low removals option. Therefore, "other" removals declines at a slower rate in this option than in the low removals option.

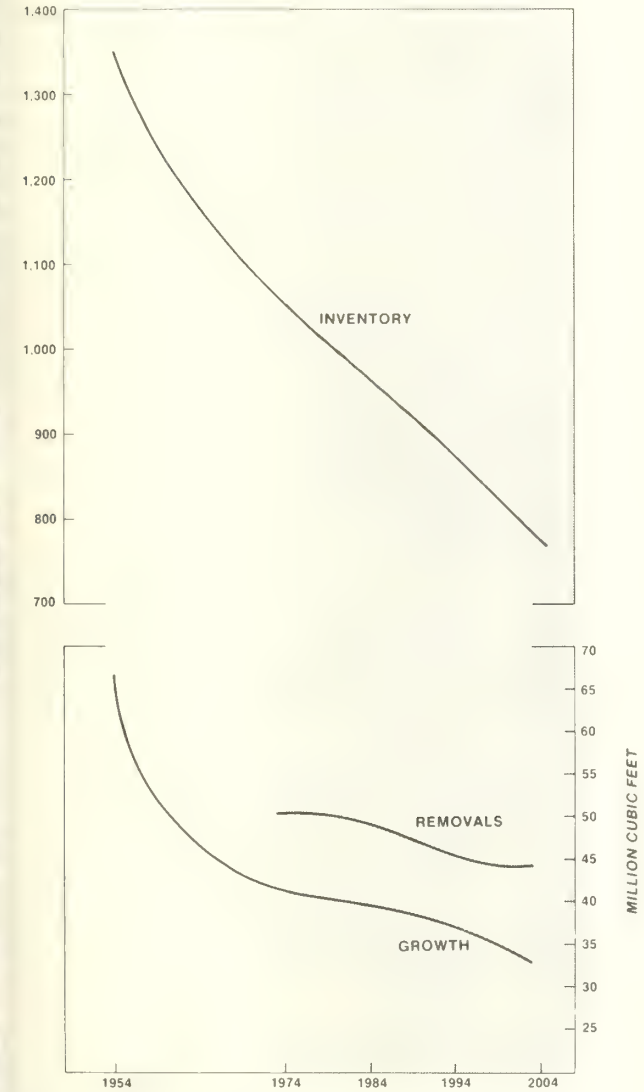


Figure 21.—*Removals, net growth, and inventory of growing stock in Iowa, 1954 and 1974, and high removals option projections for 1984-2004. Timber removals information is not available prior to 1974, and therefore, cannot be graphed. Only timber cut (which does not include logging residues and other removals) was published in 1954.*

The 41.3 million cubic feet in 1973 is projected to fall to 32.7 million in 2003, a 21 percent drop. Growth trailed removals by 9.0 million cubic feet at the beginning of the projection period, but the gap has widened to 11.6 million by the end of the period.

Given the above conditions of a wide and growing imbalance of removals over growth, in addition to a declining commercial forest area, inventory is projected to plummet from 1,054.7 million cubic feet in 1974 to 773.9 million in 2004, a loss of 27 percent.

Implications of the Projections

The low and high removals options probably prescribe the bounds of the status of Iowa's timber resource for the next 3 decades, with the actual situation falling between the two. Projections for the first decade are the most meaningful because of the uncertainty of assumptions closely related to quickly changing economic conditions.

Inventory, then, is likely to continue its downward trend in Iowa but the magnitude of the fall is dependent on several factors. If commercial forest land is taken out of production at a lower rate than assumed for the projections, inventory will mitigate its downward slide somewhat. Or if most of the commercial forest converted to other uses is of low site quality, the same effect would be exerted on inventory.

The projections assumed no change from recent trends in the level of forest management throughout the projection period. However, management activities are likely to rise and if they do, the projections will prove to be conservative.

The destiny of Iowa's timber resource lies in the hands of the State's nonindustrial private landowners, who control 91 percent of the commercial forest land. If the level of forest management is to rise appreciably or if the inventory loss is to be slowed or reversed, it will be because a substantial number of these private forest landowners found it profitable to manage their land. Expanded markets and higher prices for timber products, as well as financial incentives to landowners for tree planting and timber stand improvement, are among the stratagems for making timber growing more profitable.

FOREST MANAGEMENT OPPORTUNITIES

The rising demand for forest products nationally and the higher prices paid for them, together with a diminishing commercial forest base and a growing difference of opinion by user groups as to how it should be managed, force the public to consider ways to increase the supply of timber in the country. The following section discusses one technique used for estimating treatment opportunities and the area of commercial forest by treatment options open to forest managers during the decade 1974 to 1984 that could lead to an increased supply of timber in Iowa. The treatment classes are necessarily broad and are based on physical or silvicultural, rather than economic criteria. Other sets of criteria for determining treatment opportunities could be used, resulting in different management options from those shown in this paper. Additional treatment classes could also be added to those shown here. Foresters from the Iowa Conservation Commission participated in defining management classes, assigning treatments, and identifying management problems particular to Iowa.

The process used to determine treatment opportunities in Iowa included the following steps:

1. Each forest type found in Iowa was divided into management classes. Stands with similar physical characteristics, representing a potential treatment opportunity, were grouped into management classes according to their forest type, site index range, stand-age range, and basal area per acre range.

2. A treatment opportunity was assigned to each management class. Treatments considered included timber stand improvement (thinning and cull tree removal), harvest, and stand conversion or regeneration. Treatments assumed wood production (sawtimber or pulpwood) as the management objective, although wildlife and recreation needs were also considered. The prescription for a bur oak stand, for example, with a site index more than 49 feet, a stand-age between 55 and 65 years, and a stocking of at least 100 square feet of basal area per acre would be timber stand improvement (table 4).

3. Iowa's commercial forest was stratified into the above management classes by computer and the area of each forest type was summed by kind of treatment.

Table 4.—*Criteria used to assign commercial forest land to timber stand improvement and harvest treatment opportunities, Iowa, 1974-1984*[1]

Forest type and site index	Treatments[2]		
	Timber stand improvement		Harvest
	Age	All live tree basal area	Rotation age
	(Years)	*(Square feet acre)*	*(Years)*
Eastern redcedar-hardwoods			
All sites	25-30	100 +	80
	45-50	100 +	
White oak-red oak-hickory			
0-69	25-35	100 +	80
	55-65	100 +	
70 +	20-30	100 +	110
	50-90	100 +	
White oak			
0-69	25-35	100 +	80
	55-65	100 +	
70 +	20-30	100 +	110
	50-90	100 +	
Aspen			
All sites	40-45	100 +	60
Cottonwood			
All sites	20-25	110 +	40
Maple-basswood			
All sites	20-30	110 +	90
	50-70	110 +	
Bur oak			
0-49	—	—	60
50 +	55-65	100 +	150
Elm-ash-cottonwood			
All sites	35-45	110 +	80

[1]Where available, published management guides provided criteria for defining treatment opportunities. Criteria were modified and developed to take into account forest conditions in Iowa in discussions with Iowa Conservation Commission Foresters.

[2]Two additional treatments were considered in the analysis of treatment opportunities—no treatment and stand conversion or regeneration. Stand conversion or regeneration was assigned to all nonstocked commercial forest land and to understocked stands if basal area of all live trees was less than or equal to 19 + .38 (stand age). Stands that did not qualify for timber stand improvement, harvest, or stand conversion or regeneration were placed in the no treatment category.

No Treatment Needed on 69 Percent of Commercial Area

Under the management criteria used in this analysis of Iowa's treatment opportunities, an estimated 1,001 thousand acres of commercial forest land require no treatment during the decade (table 5). Seventy-five percent of the Western Survey Unit's commercial forests fall into this catagory, 71 percent of the Southeastern Unit's, and 64 percent of the Northeastern Unit's.

These sites are made up of stands that will not reach rotation age during the decade. Many of the stands are understocked with growing-stock trees, but a combination of their forest type, stand age, and basal area per acre make them ineligible for timber stand improvement or regeneration. Other stands are composed of species that do not respond well to the management options considered or are not commercially valuable species. Stocking is adequate in a

small portion of the stands, therefore neither thinning nor regeneration are required. However, these sites may benefit from more intensive forms of management such as pruning or fertilizing.

Stand Conversion or Regeneration Appropriate Treatment on 15 Percent of Commercial Area

Commercial forest land totaling 212 thousand acres would benefit from stand conversion or regeneration during the decade. Stands assigned this treatment fall into two general categories: (1) nonstocked commercial forest land (42 thousand acres), and (2) stands where basal area is so low in relation to stand-age that commercial timber will not be produced by rotation age (170 thousand acres). In either case, the treatment would likely result in improved utilization of the site. The bulk of the area in this treatment class is in the elm-ash-cottonwood and white oak-red oak-hickory forest types.

In general, young stands of commercially valuable forest types were selected for regeneration if the stands were growing on good sites and were selected for stand conversion if they were growing on poor sites. Forest types containing less valuable species (bur oak, for example) were selected for stand conversion even if stands were young and growing on good sites.

Only 17 percent (100 thousand acres) of the Northeastern Unit's commercial forest was selected for this treatment class. Fourteen percent (30 thousand acres) of the Western Unit's commercial area and 12 percent (82 thousand acres) of the Southwestern Unit's area were selected.

The areas of idle cropland (14 thousand acres) and wooded pasture (189 thousand acres) in need of regeneration are the total areas of idle cropland and wooded pasture in the State (table 5). Only a small amount, perhaps none, of this area will actually be regenerated to trees by the end of the decade. The entire area is included here, however, because conversion of this land to forest is an option available to land managers and represents the only real way to slow or reverse the trend of commercial forest loss.

Table 5.—*Area of nonforest land and of commercial forest land by forest type and class of treatment needed for the decade 1974 to 1984, Iowa*
(In thousand acres)

Land class and forest type	Total	Class of treatment needed			
		No treatment	Timber[1] stand improvement	Harvest	Stand[2] conversion or regeneration
NONFOREST LAND:					
Idle cropland	13.8	—	—	—	13.8
Wooded pasture	189.3	—	—	—	189.3
Subtotal	203.1	—	—	—	203.1
COMMERCIAL FOREST LAND:[3]					
Eastern redcedar-hardwood	34.9	27.1	—	—	7.8
White oak-red oak-hickory	514.8	372.5	6.7	60.7	74.9
White oak	150.1	78.8	4.5	60.6	11.2
Bur oak	157.4	107.3	—	31.1	19.0
Elm-ash-cottonwood	437.8	305.5	16.7	40.6	75.0
Cottonwood	12.3	8.2	—	4.1	—
Hard maple-basswood	143.6	101.6	8.2	9.6	24.2
Aspen	7.8	5.2	—	2.6	—
Subtotal	1,458.7	1,001.2	36.1	209.3	212.1
TOTAL	1,661.8	1,001.2	36.1	209.3	415.2

[1]Timber stand improvement includes thinning and cull tree removal on commercial forest land.

[2]Stand conversion or regeneration can occur on nonforest land or on commercial forest land if stocking in relation to age of the stand is so low that the stand is not expected to reach an adequate stocking level for commercial timber production by rotation age.

[3]Nonstocked area is distributed into the bur oak and elm-ash-cottonwood forest types.

Harvest of Mature Stands Called for on 14 Percent of Commercial Area

Timber harvest is the treatment assigned the 209 thousand acres of commercial forest that will reach rotation age or older by the end of the decade. Some form of partial cutting is anticipated to maintain an uneven-aged mix of stands in most forest types found in Iowa. On most areas that have been harvested for hardwoods, post-harvest treatment is necessary to remove undesirable or poor quality trees left because of poor markets for such trees.

Forty percent of the area of white oak type (61 thousand acres) will reach or exceed harvest age before 1984. The white oak-red oak-hickory and elm-ash-cottonwood types contribute 61 and 41 thousand acres, respectively, to this treatment class. In terms of proportion of total area of the type ready for harvest, aspen and cottonwood are significant, each with 33 percent. Most (89 percent) of the harvest area occurs in the Southeastern and Northeastern Units.

Stand-age and site index class were the principal criteria used in selecting stands for harvest. These silvicultural considerations are important to on-the-ground land managers but are used together with information on the availability and accessibility of stands to choose an active candidate for harvest. Therefore, the harvest areas above are overstated to the extent that owner preference and inaccessibility preclude their harvest.

Overstocking of Young Trees a Deterrent to Growth on 2 percent of Area

Stands selected for thinning occur on high quality sites that are overstocked with young trees. Such stands are found on 36 thousand acres of commercial forest in the State. Forty-six percent of this area is in the elm-ash-cottonwood type. Thinning in this type encourages establishment of naturally-occurring black walnut and also promotes growth and improves species composition within the type.

Thinning and cull tree removal was the treatment assigned to significant areas of the hard maple-basswood, white oak-red oak-hickory, and white oak types. None of the eastern redcedar-hardwood, bur oak, cottonwood, or aspen stands were found to fit the criteria for this treatment.

FOREST RESOURCES OTHER THAN TIMBER

Timber is a forest resource that is relatively easy t measure and whose impact in the marketplace ca readily be assessed. The quantity and values of othe forest resources, are often difficult to estimate. Fores recreation, for example, is often produced jointly wit other forest products (perhaps timber and water which makes it difficult to separate costs and return specific to recreation. And the forest wildlife resourc is mobile and can move in and out of the samplin area which makes an accurate census difficult t obtain.

Despite these difficulties, the Forest and Range land Renewable Resources Planning Act of 197 (P.L. 93-378) directs the Department of Agricultur to conduct inventories of all outputs from the Na tion's forests and rangeland, to analyze present an anticipated supplies and demand, and to suggest op portunities for improving yields. Although the dat to perform such an intensive analysis of nontimbe forest resources in Iowa are lacking at this time, general discussion of the characteristics of three suc forest resources—recreation, wildlife, and water– will be presented.

Iowa's citizens enjoy a wide range of outdoor recre ational activities at a large number of diverse facil ties. Forests play a direct or indirect role in many o these activities or facilities. Forests may serve t heighten the enjoyment of the recreational exper ence by influencing water quality, providing wildlif habitat, and enhancing the esthetic value of a site Forests also add variety to Iowa's essentially lev landscape, and, by reason of their relative scarcity contribute significantly to Iowans' quality of life.

Driving, Picnicking, Hiking Don by More Than Half the Population[13]

The Iowa Conservation Commission conducted survey in 1970 to determine the most popular forms outdoor recreation in the State. Driving for pleasu

[13]*Statistics on outdoor recreation activity partic pation from Outdoor Recreation in Iowa: A Bri Synopsis published by the Iowa Conservation Con mission. Licenses statistics are from Quickie Fac and Figures published by the Information and Ed cation Section of the Iowa Conservation Commissio*

anked first, as shown in the following tabulation, but orest-related activities were well represented:

ctivity	Iowan population participating in the activity (Percent)
riving for pleasure	78
icnicking	67
iking	51
ishing	36
oating	21
amping	16
unting	16

Several of these activities provide revenue for the State. Resident fishing licenses generated more than $1.9 million in revenue in 1974. Sale of resident hunting licenses produced $2.0 million in the same year. An additional $1.0 million was obtained through the sale of nonresident hunting licenses. Sale of boat registrations and camping permits also produce income for the State.

State of Iowa Provides Bulk of Recreation Facilities[14]

The Iowa Conservation Commission administers a diverse assortment of areas for recreational use. Many of these areas, which occupy more than 40.4 thousand acres, are on forested sites. The 71 State parks of Iowa are people-oriented developments with facilities for a variety of activities, including camping and picnicking (fig. 22). Some parks have additional natural areas for hiking and observing nature. Total attendance at Iowa State parks in 1974 was more than 12.1 million people, 432.8 thousand of whom were campers.

The Conservation Commission in Iowa administers 260 game management areas and 37 waterfowl refuges, totaling 310.5 thousand acres. Many of these areas are prairie wetlands, but some include forested wildlife habitat. Although these areas are generally considered the province of hunters, the results of a 1974 visitor survey revealed that 59 percent of the more than 1 million annual visitors are nonhunters.

[14]*Statistics on State parks, game management areas, waterfowl refuges, and State forests are from Quickie Facts and Figures. Information concerning State preserves and recreational facilities administered by agencies other than the Iowa Conservation Commission came from Outdoor Recreation in Iowa: A Brief Synopsis. Both sources are published by the Iowa Conservation Commission.*

The six State forest areas of Iowa occupy approximately 23.5 thousand acres. In addition to providing timber resources, State forests offer recreational opportunities including skiing, hiking, hunting, and primitive camping (fig. 23).

The Conservation Commission also operates State preserves—areas offering unique historic or natural qualities. Presently there are 27 State preserves in Iowa, many providing unique forest experiences. Some examples are Pecan Grove, the northernmost naturally-reproducing pecan stand of its size in existence, and White Pine Hollow, the largest stand of native white pine in the State.

Other agencies or landowners also provide recreational facilities in Iowa:

1. The federal government administers recreational areas and facilities of national historic and/or natural significance. In Iowa, the National Park Service administers the Herbert Hoover Historic Site and the Effigy Mounds National Monument; the USDI Fish and Wildlife Service manages four wildlife refuges; and the U.S. Army Corps of Engineers administers three water impoundments.

2. Most of Iowa's counties have organized county conservation boards. Working under the guidance of the State Conservation Commission, one of the functions of these boards is to develop outdoor recreational opportunities that complement State-administered areas. A total of 764 areas on approximately 50 thousand acres are administered by county boards and include parks, preserves, playgrounds, and forests.

3. Private recreation developments provide outdoor opportunities that public agencies cannot. They may function in conjunction with public facilities (as when concessions are operated by private businesses at a public facility) or fill a gap between the supply of certain public opportunities and demand by the public for that recreational opportunity.

Many Wildlife Species Dependent on Forest[15]

The forests of Iowa provide critical habitat for many wildlife species. Bobcat, ermine, hawk, squir-

[15]*Habitat and population information of squirrels and wild turkeys from Wildlife Investigations in Iowa Forests 1960-1974, by Bob Sheets, Wildlife Section, Iowa Conservation Commission. License and bag statistics from Iowa Conservation Commission's Quickie Facts and Figures.*

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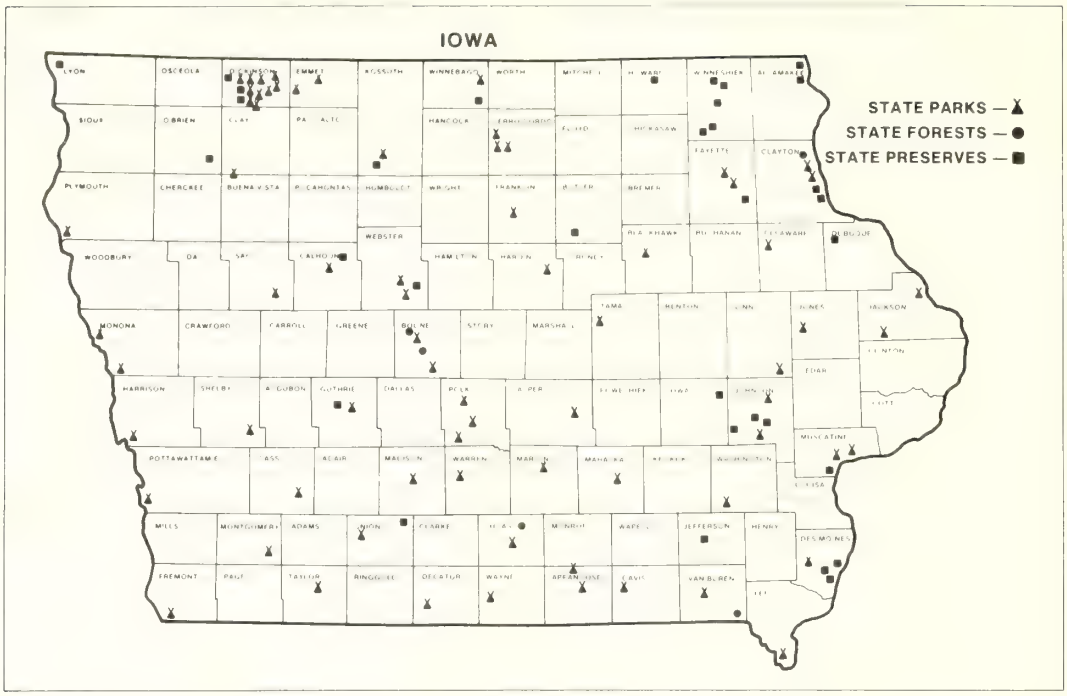

Figure 22.—*Recreational areas administered by the State of Iowa. Map adapted from information provided by the Iowa Conservation Commission.*

Figure 23.—*State Forests, like the Yellow River State Forest pictured here, offer outdoor recreational opportunities as well as being models of timber management practices.*

rel, ruffed grouse, woodcock, white-tailed deer, a many nongame wildlife species found in the Sta require forest cover to survive. A look at the habit requirements for squirrels and wild turkeys demo strates how forest land affects wildlife populatio

The grey and fox squirrels (*Sciurus niger* and *Sci rus carolinensis*) together are Iowa's third most i portant game species in terms of number of anima harvested. Approximately 40 percent of the Stat licensed hunters hunt squirrels. The fox squirr thrives in a habitat consisting of timber interspers with agriculture, but the grey squirrel requir unbroken tracts of large timber (fig. 24). Iowa Co servation Commission studies revealed that the d ference in squirrel harvests of both species in county is due, in part, to the quantity of timber that county. Other studies indicate that the fa squirrel harvest is directly related to mast produ tion during the previous year, suggesting that ma surveys may be used to predict squirrel harvest.

The wild turkey (*Meleogris gallopavo*) in the nort central States requires a habitat of mature fores that are capable of supplying a dependable source mast foods and safe roosting places. These habit

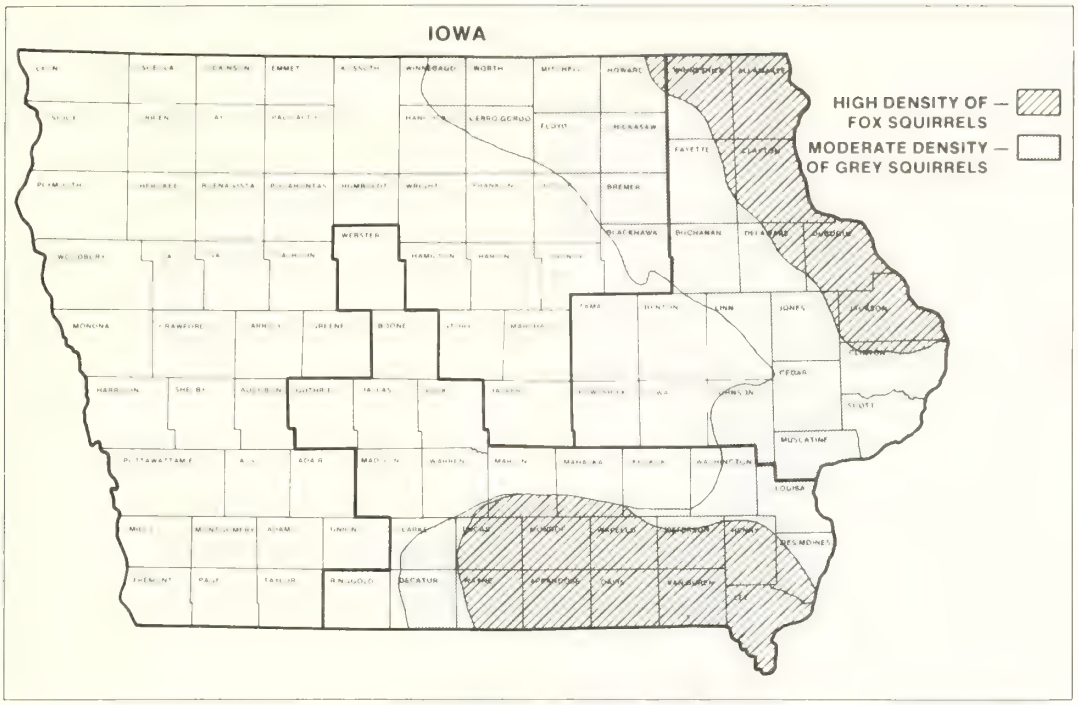

Figure 24.—*Fox and grey squirrel distribution, Iowa, 1960-1974. Map adapted from information provided by the Iowa Conservation Commission.*

onditions became scarce in the late 19th century when many forests were harvested for timber products and/or cleared for farming and development. As suitable habitat diminished, so did the wild turkey. During the 1900's, harvested forest land regenerated and some of the timber matured. Also during this period, some land previously cleared for crops was abandoned and reverted to forest land. In 1960, forest conditions suitable for turkey habitat in Iowa had improved and the State Conservation Commission began a program to reintroduce turkeys from Texas and Missouri into eastern and south-central Iowa. The wild turkey population in Iowa grew rapidly, and by 1971 it was possible to transplant birds into suitable habitat in southern and western Iowa. In 1974 a spring gobbler hunting season was established in areas known to support adequate populations of birds. Four hundred and fifty hunting permits were issued the first year and 113 birds were harvested, a 28 percent hunter success. The Conservation Commission is currently studying the potential for further distribution of wild turkeys in Iowa.

In 1974, Iowans purchased 328,769 resident fishing licenses, 175,933 resident hunting licenses, and 47,435 combination licenses.

The number one game species in Iowa in 1974 was the pheasant, both in terms of number of hunters (307,200) and in number of birds taken (1.7 million). The next most sought-after game species were rabbits (192,100 hunters took 1.3 million) and squirrels (159,000 hunters took 1.1 million). Other game harvested in substantial numbers were quail, ducks, geese, Hungarian partridges, raccoons, foxes, and coyotes.

Electric Power Generation Largest Water User in State[16]

There are more than 1,500 miles of interior streams, 33,000 acres of natural lakes, 15,000 acres of artificial lakes, and 25,650 acres of reservoirs in Iowa. The average annual precipitation for the State is 32 inches—approximately 10 percent falls in the form of snow.

Although the linkage between Iowa's forests and water resources may not be readily apparent, forests do exert a major influence on the three basic attributes of water—quantity, quality, and timing. Only 4

[16]*Information on surface waters found in the Iowa Conservation Commission's Quickie Facts and Figures. Data on water use and water quality from Projections of Population, Employment, Income and Water Use for Iowa River Basins 1975-2020 by Jerald R. Bernard and Warren T. Dent, Institute for Economic Research, University of Iowa.*

percent of Iowa's total land area is forested, however, many of the State's riverbanks and flood plains have forest cover. More than 20 percent of Iowa's commercial forest land is within ⅛ of a mile of water. Through interception of precipitation and evaporation, forests affect the quantity and timing of water reaching streams, lakes, and reservoirs. The structure of soils developed under forests encourages infiltration of rainfall and snow melt, which also affects timing and quantity of water yield. By providing ground cover and soil stabilization, forests reduce erosion and sedimentation, thereby improving water quality.

In 1970, an estimated 2,156 million gallons of water (excluding that used for hydroelectric power) were withdrawn from ground and surface water supplies in Iowa each day, with a consumption of 238 million gallons per day. This compares with the estimate for 1960 of 2,100 million gallons withdrawn and 230 million gallons consumed. Consumption represents the net depletion of water either because it has evaporated or because it is in a form not returnable to a body of water to be used again. The difference between the volume of water withdrawn and the water consumed (1,918 million gallons per day in 1970) is the volume of water used and returned to a body of water so it may be used again. Shown below are the estimated daily uses of water in Iowa in 1970:[17]

Major uses	Withdrawn (from ground and surface water)	Consumed
	(Million gallons per day)	
Public supplies[18]	250	37
Rural use[19]	180	150
Irrigation	26	26
Self-supplied industrial use[20]	1,700	25
Subtotal	2,156	238
Hydroelectric power	35,000	([21])
GRAND TOTAL	37,156	238

[17]*Source: U.S. Geological Survey, "Estimated Use of Water in the United States, 1970," Circular 676, Washington, D.C., 1972.*

[18]*Includes industrial, commercial, and domestic uses.*

[19]*Includes domestic and livestock uses.*

[20]*Includes electric utility and other uses.*

[21]*Not shown.*

The bulk of the rural consumption, highest of t major uses of water, was for livestock use. Althou irrigation only accounted for 11 percent of the 19 consumption, its share of the total is expected increase substantially in the future, as it has in su rounding States.

In addition to these uses, an estimated 35 billi gallons of water per day were used to generate hydr electric power. This easily makes the electric utili sector the largest water user in the State.

The Iowa Department of Environmental Quali began monitoring the water quality of many of Iowa lakes and streams in 1970. Monitoring has reveale an improvement in the levels of ammonia nitroge and oxygen depletion, water quality factors that a used as indicators of the degree of pollution fro point sources.[22] Iowa has an estimated 600 poi sources of pollution, and the Department of Enviro mental Quality estimates that all or most meet th 1977 water quality standards for best practicab treatment. Water turbidity and nitrate levels i water supplies are two indicators of the degree pollution from nonpoint sources, such as runoff fro domestic animal feedlots or of chemical fertiliz from farmers fields. In Iowa, these factors sugges that more needs to be done to control this kind pollution.

[22]*A point source of pollution is any activity where the discharge of the polluting substance can be measured, regulated, and treated. A nonpoint source o pollution is any polluting activity not classified as a point source.*

APPENDIX

ACCURACY OF SURVEY

Forest Survey information is based on a sampling procedure designed to provide reliable statistics at the State and Survey Unit levels. Consequently, the reported figures are estimates only. However, a measure of reliability of these figures is given by sampling errors. These sampling errors may be interpreted as meaning that the chances are two out of three that the results for the sample differ, by no more than the amount indicated, from the results that would have been obtained if all trees in the State had been measured (a 100-percent inventory), using the same tree measurements.

For example, the estimated area of commercial forest land in the State in 1974, 1,458.7 thousand acres, has a sampling error of 2.25 percent (± 32.8 thousand acres). Therefore, the chances are two out of three that the commercial forest area falls between 1,425.9 and 1,491.5 thousand acres, the limits within which the results of a 100-percent inventory would occur.

Item	State totals		Sampling error[23] (Percent)
Growing stock:			
Volume	1,054.7	Million cu. ft.	3.96
Growth	41.3	Million cu. ft.	5.35
Removals	50.3	Million cu. ft.	19.93
Sawtimber:			
Volume	3,486.5	Million board ft.	4.67
Growth	79.8	Million board ft.	6.21
Removals	163.3	Million board ft.	18.43
Commercial forest land:	1,458.7	Thousand acres	2.25

As survey data are broken down into units smaller than State or Survey Unit totals, the sampling error increases (table 6). The smaller the breakdown, the larger the sampling error.

[23] *At the 67-percent probability level.*

SURVEY PROCEDURE

The major steps in the Iowa survey were as follows:

1. A total of 398,046, 1-acre points distributed systematically across aerial photos of the entire State were observed. A photo interpreter classified these points as either forest land (19,111), questionable (1,662), or nonforest land (377,273) in order to make a preliminary estimate of forest area. Next, 9,541 o the forest points and 831 of the questionable points were stereoclassifed as to forest type, stand-size class, and density. Then, 636 points classed as forest, 55 points classed as questionable, and 11,940 points classed as nonforest were examined on the ground. This procedure provides a means for adjusting the initial estimates of area for change in land use since date of photography and for photo misclassifications.

Estimates of timber volume, growth, mortality, and forest classifications were based on tree measurements recorded at 531 ground sample locations distributed within the commercial forest land base. A 10-point cluster of plots (37.5 basal area factor) were systematically spaced on an acre at each of these sample locations.

2. Ownership information was collected by contacting local landowners and from public records.

3. Industrial roundwood data for 1972 came from a complete canvass of primary wood-using firms using Iowa logs and bolts. All canvassing in Iowa (except pulpmills) was done by the Iowa Conservation Commission through personal contacts with the firms. The North Central Forest Experiment Station sent questionnaires to Iowa pulpmills and out-of-State mills using Iowa roundwood.

The Station also obtained by mail questionnaire the 1972 timber product output data for public forest land and forest land owned by primary wood-using firms. The portion of timber products output unaccounted for by public and private industrial owners was grouped under "farm and other owners".

Fuelwood, post, and farm timber production in 1972 from private land (other than industrial) was determined by a canvass of a sample of Iowa households. Households in the sample were contacted by Iowa Conservation Commission personnel.

Table 6.—*Sampling errors*[1] *for estimates smaller than State totals of volume, net growth, and removals, and of area of commercial forest land in Iowa, 1974*

Sampling error (percent)	Commercial forest area	Growing stock			Sawtimber		
		Volume	Growth	Removals	Volume	Growth	Removal
	Acres	*—Million cubic feet—*			*—*[2]*Million board feet—*		
1	7,376,700	16,532.4	1,378.3	22,720.1	76,108.2	4,076.4	61,985.
2	1,844,200	4,133.1	344.6	5,680.0	19,027.0	1,019.1	15,496.
3	819,600	1,836.9	153.1	2,524.5	8,456.5	452.9	6,887.
4	461,000	1,033.3	86.1	1,420.0	4,756.8	254.8	3,874.
5	295,100	661.3	55.1	908.8	3,044.3	163.1	2,479.
10	73,800	165.3	13.8	227.2	761.1	40.8	619.
15	32,800	73.5	6.1	101.0	338.3	18.1	275.
20	18,400	41.3	3.4	56.8	190.3	10.2	155.
25	11,800	26.5	2.2	36.4	121.8	6.5	99.
50	2,900	6.6	0.5	9.1	30.4	1.6	24.
100	700	1.7	0.1	2.3	7.6	0.4	6.

[1]*At the 67-percent probability level. Figures in the table show areas or volumes that have the sampling error shown in the column at the extreme left. For example, a commercial forest area of 7,376.7 thousand acres has a sampling error of ± 1 percent, and an area of 295.1 thousand acres has an error of ± 5 percent. Sampling errors for areas or volumes between those listed can be approximated by interpolation.*

[2]*International ¼-inch rule.*

4. Wood utilization factors developed during the 1971-1972 utilization study in Missouri were used to convert timber products output to timber removals for saw logs, veneer logs, cooperage logs, and pulpwood. Factors for all other products were obtained during the 1959-1960 Missouri utilization study.

5. All field data were sent to St. Paul where they were edited, punched on cards, and stored on magnetic tape for later electronic computer sorting, computing, and tabulating.

LOG GRADE

Log grade data developed during the 1972 Missouri Forest Inventory were used to distribute Iowa's timber volume into log-grade classes.

METRIC EQUIVALENTS OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare
1,000 acres = 405 hectares
1,000 board feet (International ¼-inch rule) = 3.4 cubic meters.
Breast height = 1.4 meters above the ground.
1 cord (solid wood, pulpwood) = 2.237 cubic meters
1 cubic foot = 28,317 cubic centimeters or 0.02831 cubic meter.
1,000 cubic feet = 28.317 cubic meters.
1 foot = 30.48 centimeters or 0.3048 meters.
1 inch = 25.4 millimeters or 2.54 centimeters or 0.0254 meter.

DEFINITION OF TERMS

Land-Use Classes

Gross area.—The entire area of land and water as determined by the Bureau of Census, 1970.

Land area.—The area of dry land and land temporarily or partially covered by water such as marshes, swamps, flood plains, streams, sloughs, and estuaries. Canals less than ⅛-mile wide and lakes, reservoirs, and ponds smaller than 40 acres are included as land area. These figures are from the Bureau of Census, 1970.

Forest land.—Land at least 16.7 percent stocked by forest trees of any size, or normally having such tree cover, and not currently developed for nonforest use. Includes afforested areas. The minimum forest area classified was 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas were classed as forest if less than 120 feet wide.

Commercial forest land.—Forest land that is producing or is capable of producing crops of industrial wood and that is not withdrawn from timber utilization by statute or administrative regulation. This includes areas suitable for management to grow crops of industrial wood generally of a site quality capable of producing in excess of 20 cubic feet per acre of annual growth. This includes both inaccessible and inoperable areas.

Noncommercial forest land.—(a) Unproductive—forest land incapable of yielding crops of industrial wood because of adverse site conditions. (b) Productive-reserved—forest land withdrawn from commercial timber use through statute or administrative regulation, or exclusively used for Christmas tree production.

Nonforest land.—Land that has never supported forests, and land formerly forested where forest use is precluded by development for nonforest uses. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide, and clearings in forest areas must be more than 1 acre in size, to qualify as nonforest land. Nonforest land classes include:

A. Nonforest with trees:

(1.) Improved pasture with trees—land developed for grazing domestic livestock and less than 16.7 percent stocked (basal area stocking) with live trees. Grazing developments include fencing, seeding to grass, clearing trees or brush, and constructing livestock water facilities.

(2.) Wooded pasture—improved pasture at least 16.7 stocked with live trees but less than 25 percent stocked with growing-stock trees. Wooded pasture is land stocked sufficiently with trees to be classed as forest land but on which the present highest use is forage production for livestock. The latter is determined by the presence of livestock and the performance of grazing improvements. If the present highest use of such land changes, as evidenced by the removal of livestock, the land would be classed as forest land.

(3.) Wooded strips—continuous forest land at least 1 acre in area that meets the Resources Evaluation standards for commercial forest land except for being less than 120 feet wide.

(4.) Idle farmland with trees—farmland not tended within the last 2 years and less than 16.7 percent stocked with live trees.

(5.) Windbreak—planted windbreak less than 120 feet wide, or smaller than 1 acre in area, or both.

B. Nonforest without trees:

(1.) Urban and other—areas within the legal boundaries of cities and towns; suburban areas developed for residential, industrial, and recreational purposes; schoolyards; cemeteries; roads; railroads; airports; and powerlines and other rights-of-way.

Ownership classes

Federal.—Land owned by the federal government. Iowa has no National Forest, Indian, or Bureau of Land Management land.

State, county, and municipal.—Land owned by States, counties, or local public agencies, or land leased by them for more than 50 years.

Forest industry.—Land owned by companies or individuals operating primary wood-using plants.

Farmer.—Land owned by operators of farms. A farm must include 10 or more acres from which the

sale of agricultural products totals $50 or more annually, or if less than 10 acres, the yield must be at least $250 annually.

Miscellaneous private.—Privately owned land other than forest industry or farmer-owned.

Tree Classes

All live trees.—Growing-stock, rough, and rotten trees 1 inch d.b.h. and larger.

Growing-stock trees.—All live trees of commercial species qualifying as desirable or acceptable trees. Excludes rough, rotten, and dead trees.

Desirable trees.—Growing-stock trees having no serious defects in quality limiting present or prospective use, and of relatively high vigor and containing no pathogens that may result in death or serious deterioration before rotation age. These trees would be favored by forest managers in silvicultural operations.

Acceptable trees.—Trees meeting the standards for growing stock but not qualifying as desirable trees.

Sawtimber trees.—Growing-stock trees of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs, each 8 feet or longer. At least 33 percent of the gross volume of the tree must be sound wood. Softwoods must be at least 9.0 inches d.b.h. and hardwoods at least 11.0 inches d.b.h.

Poletimber trees.—Growing-stock trees of commercial species at least 5.0 inches d.b.h. but smaller than sawtimber size and of good form and vigor.

Saplings.—Live trees of commercial species 1.0 to 5.0 inches d.b.h. and of good form and vigor.

Seedlings.—Live trees of commercial species less than 1.0 inch d.b.h. that are expected to survive according to regional standards. (Examples of seedlings not expected to survive are those that are diseased or heavily damaged by logging, browsing, or fire.) Only softwood seedlings more than 6 inches tall and hardwood seedlings more than 1 foot tall are counted.

Rotten trees.—Live trees (any size) of commercial species that do not contain a merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of rot (that is, when more than 50 percent of the cull volume of the tree is rotten).

Rough trees.—Live trees that do not contain at least one merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of roughness and poor form, as well as all live noncommercial species.

Short-log (rough trees).—Sawtimber-sized trees of commercial species that contain at least one merchantable 8- to 11-foot saw log but not a 12-foot saw log.

Stocking

The degree of utilization of land by trees as measured in terms of basal area and/or the number of trees in a stand compared to the basal area and/or the number of trees required to fully utilize the growth potential of the land.

A stocking percent of 100 indicates full utilization of the site and is equivalent to 80 square feet of basal area per acre in trees 5 inches d.b.h. and larger. In a stand of trees less than 5 inches d.b.h., a stocking percent of 100 percent would indicate that the present number of trees is sufficient to produce 80 square feet of basal area per acre when the trees do reach 5 inches d.b.h.

Stocking of all live trees, growing-stock trees, and desirable trees are recorded separately and stands are grouped into the following stocking classes.

Stocking Classes

Overstocked stands.—Stands in which stocking of trees is 133 percent or more.

Fully stocked stands.—Stands in which stocking of trees is from 100 to 133 percent.

Medium stocked stands.—Stands in which stocking of trees is from 60 to 100 percent.

Poorly stocked stands.—Stands in which stocking of trees is from 16.7 to 60 percent.

Nonstocked areas.—Commercial forest land on which stocking of growing-stock trees is less than 16.7 percent.

Area-condition Classes

Class 10.—Areas fully stocked with desirable trees but not overstocked.

Class 20.—Areas fully stocked with desirable trees but overstocked with all live trees.

Class 30.—Areas medium to fully stocked with desirable trees and with less than 30 percent of the area controlled by other trees and/or inhibiting vegetation or surface conditions that will prevent occupancy by desirable trees.

Class 40.—Areas medium to fully stocked with desirable trees and with 30 percent or more of the area controlled by other trees and/or conditions that ordinarily prevent occupancy by desirable trees.

Class 50.—Areas poorly stocked with desirable trees but fully stocked with growing-stock trees.

Class 60.—Areas poorly stocked with desirable trees but with medium to full stocking of growing-stock trees.

Class 70.—Areas poorly stocked with desirable trees and poorly stocked with growing-stock trees.

Stand-size Classes

Stand.—A growth of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

Sawtimber stands.—Stands at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber or poletimber trees and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.—Stands at least 16.7 percent stocked with growing-stock trees and with half or more of this stocking in sawtimber and/or poletimber trees and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands.—Stands at least 16.7 percent stocked with growing-stock trees and with saplings and/or seedlings comprising more than half of this stocking.

Nonstocked areas.—Commercial forest land on which stocking of growing-stock trees is less than 16.7 percent.

Other Classifications

Site index.—An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Site classes.—A classification of forest land in terms of inherent capacity to grow crops of industrial wood expressed in cubic-foot growth per acre per year.

Stand-age.—Age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Basal area.—The area in square feet of the cross section at breast height of a single tree. When the basal area of all live trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Forest Types

A classification of forest land based upon the species forming a plurality of live-tree stocking. Land less than 16.7 percent stocked is classed as nonstocked. Major forest types in Iowa are:

Eastern redcedar-hardwood.—Forests in which hardwoods (usually upland oaks) comprise a plurality of all stocking but in which eastern redcedar comprises 25 to 50 percent of the stocking.

White oak-red oak-hickory.—Forests in which white oak, northern red oak, black oak, northern pin oak, bur oak, shagbark or bitternut hickory, singly or in combination, comprise a plurality of the stocking. Common associates include white or green ash, sugar maple, and occasionally black cherry, butternut, bigtooth aspen, and black walnut. The type is often referred to by the generic term "oak-hickory".

White oak.—Forests in which white oak comprises more than 50 percent of the stocking of the primary typing species for the oak-hickory type. Associated species are black oak, northern red oak, bur oak, shagbark and bitternut hickories, white ash, and bigtooth aspen.

Bur oak.—Forests in which bur oak comprises more than 50 percent of the stocking of the primary typing species for the oak-hickory type. Associated species include northern pin oak, northern red oak, white oak, black oak, basswood, American elm, green ash, boxelder, hackberry, cottonwood, and hophornbeam.

Elm-ash-cottonwood.—Forests in which elm, ash, or cottonwood, singly or in combination, comprise a plurality of the stocking. Associates include black willow, sycamore, boxelder, silver maple, river birch, and other moist site hardwood species.

Cottonwood.—Forests in which cottonwood comprises a plurality of the stocking of the major typing species of the elm-ash-cottonwood type.

Hard maple-basswood.—Forests in which sugar maple or basswood, singly or in combination, com-

prise a plurality of the stocking. Associated species include American elm, green ash, yellow birch, white pine, and northern red oak.

Aspen.—Forests in which quaking aspen or bigtooth aspen, singly or in combination, comprise a plurality of the stocking. Associates include bur oak, green ash, American elm, paper birch, and boxelder.

Timber Volume

Volume of growing stock.—The volume of sound wood in the bole of growing-stock trees 5.0 inches d.b.h. and over, from a 1-foot stump to a minimum of 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs. Growing-stock volumes are shown in cubic feet.

Volume of sawtimber.—Net volume of the saw log portion of live sawtimber trees in board feet, International ¼-inch rule, from stump to a minimum 7 inches top diameter outside bark for softwoods and 9 inches for hardwoods.

Upper stem portion.—That part of the bole of sawtimber trees above the merchantable sawtimber top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Growth and Mortality

Net annual growth of growing stock.—The annual change in volume of sound wood in live growing-stock and sawtimber trees and the total volume of trees entering these classes through ingrowth, less volume losses resulting from natural causes.

Net annual growth of sawtimber.—The annual change in volume of live sawtimber trees and the total volume of trees reaching sawtimber size, less volume losses resulting from natural causes.

Mortality of growing stock.—The volume of sound wood in growing-stock trees dying annually from natural causes. Natural causes include fire, insects, disease, animal damage, weather, and suppression.

Mortality of sawtimber.—The net board-foot volume of sawtimber trees dying annually from natural causes.

Timber Removals

Timber removals from growing stock.—The volume of sound wood in growing-stock trees removed annually for forest products (including roundwood and logging residues) and for other removals. Roundwood products are logs, bolts, or other round sections cut and used from trees. Logging residues are the unused portions of cut trees plus unused trees killed by logging. Other removals are growing-stock trees removed but not utilized for products or trees left standing but "removed" from the commercial forest land classification by land use change—examples are removals from cultural operations such as timber stand improvement work, land clearing, and changes in land use.

Timber removals from sawtimber.—The net board-foot volume of live sawtimber trees removed for forest products annually (including roundwood products and logging residues) and for other removals.

Timber products output.—All timber products cut from roundwood, and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulpmills that are used as pulp chips or other products.

Plant byproducts.—Wood products, such as pulpwood chips, obtained incidental to production of other manufactured products. Byproducts are broken into:

Coarse plant byproducts.—Wood suitable for chipping, such as slabs, edgings, and veneer cores.

Fine plant byproducts.—Wood not suitable for chipping, such as sawdust and veneer clippings.

Plant residues.—Wood materials from manufacturing plants not utilized for products.

PRINCIPAL TREE SPECIES IN IOWA[24]

SOFTWOOD SPECIES:

- Balsam fir ..... *Abies balsamea*
- Eastern redcedar ..... *Juniperus virginiana*
- Eastern white pine ..... *Pinus strobus*

HARDWOOD SPECIES:

Select white oaks:
- White oak ..... *Quercus alba*
- Swamp white oak ..... *Quercus bicolor*
- Bur oak ..... *Quercus macrocarpa*
- Chinkapin oak ..... *Quercus muehlenbergii*

Other white oaks:
- Overcup oak ..... *Quercus lyrata*
- Post oak ..... *Quercus stellata var. stellata*

Select red oaks:
- Northern red oak ..... *Quercus rubra*

Other red oaks:
- Northern pin oak ..... *Quercus ellipsoidalis*
- Shingle oak ..... *Quercus imbricaria*
- Pin oak ..... *Quercus palustris*
- Black oak ..... *Quercus velutina*

Hickory:
- Bitternut hickory ..... *Carya cordiformis*
- Shellbark hickory ..... *Carya laciniosa*
- Shagbark hickory ..... *Carya ovata*
- Mockernut hickory ..... *Carya tomentosa*

Hard maple:
- Black maple ..... *Acer nigrum*
- Sugar maple ..... *Acer saccharum*

Soft maple:
- Silver maple ..... *Acer saccharinum*

Ashes:
- White ash ..... *Fraxinus americana*
- Black ash ..... *Fraxinus nigra*
- Green ash ..... *Fraxinus pennsylvanica*

Eastern cottonwood ..... *Populus deltoides*

Aspens:
- Bigtooth aspen ..... *Populus grandidentata*
- Quaking aspen ..... *Populus tremuloides*

American basswood ..... *Tilia americana*

Elms:
- American elm ..... *Ulmus americana*
- Slippery elm ..... *Ulmus rubra*
- Rock elm ..... *Ulmus thomasii*

Black walnut ..... *Juglans nigra*

Black cherry ..... *Prunus serotina*

Hackberry ..... *Celtis occidentalis*

Black willow ..... *Salix nigra*

Birches:
- River birch ..... *Betula nigra*
- Paper birch ..... *Betula papyrifera*

Other hardwoods:
- Boxelder ..... *Acer negundo*
- Ohio buckeye ..... *Aesculus glabra*
- Honeylocust ..... *Gleditsia triacanthos*
- Kentucky coffeetree ... *Gymnocladus dioicus*
- Butternut ..... *Juglans cinerea*
- Osage-orange ..... *Maclura pomifera*
- Red mulberry ..... *Morus rubra*
- Sycamore ..... *Platanus occidentalis*
- Black locust ..... *Robinia pseudoacacia*

[24] *The common and scientific names are based on: Little, Elbert L., Jr. 1979. Checklist of United States Trees (Native and Naturalized). U.S. Department of Agriculture, Agriculture Handbook 541, 375 p.*

Table 7.--Area by land class and by Forest Survey Unit, Iowa, 1974

(In thousand acres)

Land class	All units	Northeastern	Southeastern	Western
FOREST LAND:				
Commercial	1,458.7	584.5	659.4	214.8
Productive reserved	75.9	23.1	43.4	9.4
Unproductive	26.7	6.9	5.5	14.3
Total	1,561.3	614.5	708.3	238.5
NONFOREST LAND:				
Nonforest with trees:				
Wooded pasture	189.3	101.8	68.1	19.4
Wooded strips	179.5	33.7	74.7	71.1
Improved pasture	314.4	86.6	161.8	66.0
Cropland	160.8	48.4	27.6	84.8
Idle farmland	13.8	--	13.8	--
Windbreaks	8.0	--	--	8.0
Subtotal	865.8	270.5	346.0	249.3
Nonforest without trees:				
Cropland[1/]	28,131.4	7,087.6	8,021.5	13,022.3
Other farmland	3,606.1	719.6	1,568.4	1,318.1
Marsh	70.3	29.6	8.4	32.3
Urban and other	1,632.7	464.5	657.0	511.2
Subtotal	33,440.5	8,301.3	10,255.3	14,883.9
Total	34,306.3	8,571.8	10,601.3	15,133.2
Total land area[2/]	35,867.6	9,186.3	1,309.6	15,371.7

[1/] 1969 Census of Agriculture

[2/] United States Bureau of the Census, Land and Water Area of the United States, 1970.

Table 8.--Area of land and forest land by counties, Iowa, 1974

Survey Unit and county	All land[1/]	Forest land 2/			Percent commercial forest
		Total	Commercial[3/]	Non-commercial[4/]	
	- - - - - - - - - -Thousand acres- - - - - - - - -				
NORTHEASTERN					
Allamakee	406.8	101.8	100.3	1.5	25
Benton	459.3	15.3	14.7	0.6	3
Black Hawk	363.5	12.9	9.8	3.1	3
Bremer	281.0	12.6	12.2	0.4	4
Buchanan	363.6	11.2	10.3	0.9	3
Butler	372.5	9.3	8.8	0.5	3
Cedar	374.4	15.6	15.2	0.4	4
Chicksaw	323.4	8.1	7.8	0.3	2
Clayton	498.8	84.4	82.1	2.3	16
Clinton	443.8	24.0	23.6	0.4	5
Delaware	365.8	19.4	17.1	2.3	5
Dubuque	391.8	38.2	36.7	1.5	9
Fayette	465.9	28.0	27.2	0.8	6
Floyd	321.9	7.7	7.3	0.4	2
Grundy	320.6	0.7	0.6	0.1	--
Howard	301.4	6.5	6.2	0.3	2
Jackson	412.0	57.6	56.3	1.3	14
Johnson	396.4	25.2	19.1	6.1	5
Jones	374.4	28.3	27.4	0.9	7
Linn	458.8	32.3	28.3	4.0	6
Mitchell	298.8	5.0	4.8	0.2	2
Scott	290.3	10.8	10.4	0.4	4
Tama	460.8	19.8	19.2	0.6	4
Winneshiek	440.3	39.8	39.	0.7	9
Total	9,186.3	614.5	584.5	30.0	6
SOUTHEASTERN					
Appanoose	334.7	30.5	25.2	5.3	8
Boone	366.7	22.4	18.0	4.4	5
Clarke	274.5	22.5	22.2	0.3	8
Dallas	382.0	19.2	17.4	1.8	5
Davis	325.9	26.8	25.9	0.9	8
Decatur	339.2	29.2	28.0	1.2	8
Des Moines	261.2	26.0	25.0	1.0	10
Guthrie	381.4	25.5	24.4	1.1	6
Hamilton	369.5	6.2	6.0	0.2	2
Hardin	367.2	9.5	8.9	0.6	2
Henry	281.6	23.0	21.9	1.1	8
Iowa	373.6	18.2	18.0	0.2	5
Jasper	470.0	12.0	11.3	0.7	2
Jefferson	279.0	17.8	17.6	0.2	6
Keokuk	370.5	16.0	15.8	0.2	4
Lee	337.5	50.7	50.0	0.7	15
Louisa	258.0	22.2	22.2	—	9
Lucas	277.6	31.7	29.4	2.3	11
Madison	361.0	26.0	25.4	0.6	7
Mahaska	366.0	15.5	15.1	0.4	4
Marion	362.9	26.7	17.4	9.3	5
Marshall	367.4	8.5	7.9	0.6	2
Monroe	278.4	34.4	34.1	0.3	12
Muscatine	283.2	19.2	18.7	0.5	7
Polk	380.0	17.3	10.1	7.2	3
Poweshiek	377.0	7.6	7.3	0.3	2
Story	363.5	5.5	5.2	0.3	1
Van Buren	311.6	38.2	36.0	2.2	12
Wapello	279.4	23.3	23.0	0.3	8
Warren	365.8	24.2	22.7	1.5	6
Washington	363.5	18.7	17.2	1.5	5
Wayne	340.3	15.9	14.8	1.1	4
Webster	459.5	17.9	17.3	0.6	4
Total	11,309.6	708.3	659.4	48.9	6

(Table 8 continued on next page)

(Table 8 continued)

WESTERN

Survey Unit and county	All land 1/	Forest land 2/ Total	Commercial 3/	Non-commercial 4/	Percent commercial forest
Adair	364.2	6.2	5.7	0.5	2
Adams	272.6	7.6	7.1	0.5	3
Audubon	286.7	1.3	1.1	0.2	--
Buena Vista	366.3	2.4	2.1	0.3	1
Calhoun	365.6	0.6	0.5	0.1	--
Carroll	367.3	1.0	0.5	0.5	--
Cass	357.8	2.7	2.5	0.2	1
Cerro Gordo	368.1	0.9	0.6	0.3	--
Cherokee	366.7	4.7	4.0	0.7	1
Clay	364.9	3.9	3.4	0.5	1
Crawford	458.2	4.6	4.2	0.4	1
Dickinson	242.9	0.6	0.4	0.2	--
Emmet	252.3	2.7	2.0	0.7	1
Franklin	375.0	3.3	2.7	0.6	1
Fremont	335.2	14.0	12.4	1.6	4
Greene	364.1	6.4	5.8	0.6	2
Hancock	364.9	0.9	0.5	0.4	--
Harrison	445.3	30.5	28.2	2.3	6
Humboldt	278.4	2.5	2.2	0.3	1
Ida	275.8	0.5	0.3	0.2	--
Kossuth	626.6	2.5	2.3	0.2	--
Lyon	376.3	1.7	1.6	0.1	--
Mills	285.8	12.7	11.9	0.8	4
Monona	447.5	25.1	22.5	2.6	5
Montgomery	270.1	4.7	4.2	0.5	2
O'Brien	367.9	1.3	1.1	0.2	--
Osceola	254.6	0.1	0.1	--	--
Page	342.4	7.3	6.9	0.4	2
Palo Alto	358.7	1.5	1.4	0.1	--
Plymouth	552.3	5.2	4.8	0.4	1
Pocahontas	371.6	0.8	0.8	--	--
Pottawattamie	616.4	13.9	12.9	1.0	2
Ringgold	344.1	15.2	14.1	1.1	4
Sac	370.0	1.7	1.4	0.3	--
Shelby	375.7	1.8	1.6	0.2	--
Sioux	490.3	1.0	0.7	0.3	--
Taylor	337.7	10.3	9.5	0.8	3
Union	272.0	15.4	14.5	0.9	5
Winnebago	256.7	0.3	0.2	0.1	--
Woodbury	557.6	14.5	12.6	1.9	2
Worth	256.1	1.6	1.1	0.5	--
Wright	369.0	2.6	2.4	0.2	1
Total	15,371.7	238.5	214.8	23.7	1
State total	35,867.6	1,561.3	1,458.7	102.6	4

1/ 1970 Bureau of the Census estimates.

2/ Land at least 16.7 percent stocked by forest trees of any size, or formerly having such tree cover: excludes lands currently developed for nonforest use such as urban or heavily settled residential or resort area, city parks, orchards, improved roads, or improved pasture lands. The minimum forest area classified was 1 acre. Roadside, streamside, and shelterbelt strips of timber with crown width of at least 120 feet and unimproved roads and trails, streams, and clearings in forested areas if less than 120 feet in width were classified as forest.

3/ Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation.

4/ Unproductive forest land incapable of yielding crops of industrial wood because of adverse site conditions and productive public forest land withdrawn from commercial timber production through a statute or administrative regulation.

Table 9.--Area of commercial forest land by ownership class, Iowa 1974

(In thousand acres)

Ownership class	Area
Federal	55.2
State	51.3
County and municipal	4.7
Forest industry	16.7
Farmer	987.0
Miscellaneous private	
Individual	304.9
Corporate	38.9
All owners	1,458.7

Table 10.--Area of commercial forest land by ownership class and Forest Survey Unit, Iowa, 1974

(In thousand acres)

Ownership class	All units	North-eastern	South-eastern	Western
Public	111.2	58.6	37.0	15.6
Forest industry	16.7	3.7	13.0	--
Farmer	987.0	384.7	443.6	158.7
Miscellaneous private	343.8	137.5	165.8	40.5
All owners	1,458.7	584.5	659.4	214.8

Table 11.--Area of commercial forest land by stand-size class, ownership class, and Forest Survey Unit, Iowa, 1974

(In thousand acres)

Unit and stand-size class	All owners	Ownership class			
		Public	Forest industry	Farmer	Misc. private
NORTHEASTERN					
Sawtimber	375.2	34.3	2.6	249.9	88.4
Poletimber	123.2	12.8	0.7	86.4	23.3
Sapling and seedling	61.0	11.5	--	33.7	15.8
Nonstocked	25.1	--	0.4	14.7	10.0
All classes	584.5	58.6	3.7	384.7	137.5
SOUTHEASTERN					
Sawtimber	316.8	31.8	6.0	192.9	86.1
Poletimber	179.4	5.2	3.7	126.1	44.4
Sapling and seedling	152.8	--	3.2	117.1	32.5
Nonstocked	10.4	--	0.1	7.5	2.8
All classes	659.4	37.0	13.0	443.6	165.8
WESTERN					
Sawtimber	89.4	3.2	--	61.8	24.4
Poletimber	54.0	3.1	--	36.5	14.4
Sapling and seedling	64.5	5.7	--	58.1	0.7
Nonstocked	6.9	3.6	--	2.3	1.0
All classes	214.8	15.6	--	158.7	40.5
ALL UNITS					
Sawtimber	781.4	69.3	8.6	504.6	198.9
Poletimber	356.6	21.1	4.4	249.0	82.1
Sapling and seedling	278.3	17.2	3.2	208.9	49.0
Nonstocked	42.4	3.6	0.5	24.5	13.8
All classes	1,458.7	111.2	16.7	987.0	343.8

Table 12.--Area of commercial forest land by area-condition class and ownership class, Iowa, 1974

(In thousand acres)

Area-condition class	All owners	Ownership class			
		Public	Forest industry	Farmer	Misc. private
20	2.1	--	--	2.1	--
30	--	--	--	--	--
40	2.0	0.3	--	--	1.7
50	99.6	23.7	0.9	47.8	27.2
60	501.7	37.0	6.5	338.2	120.0
70	853.3	50.2	9.3	598.9	194.9
All classes	1,458.7	111.2	16.7	987.0	343.8

Table 13.--Area of commercial forest land by site class and ownership class, Iowa, 1974

(In thousand acres)

Site class (cubic feet of growth/acre/year)	All owners	Ownership class			
		Public	Forest industry	Farmer	Misc. private
225+	3.4	--	--	3.4	--
165-224	--	--	--	--	--
120-164	37.3	17.7	0.2	10.2	9.2
85-119	115.1	21.1	1.3	61.0	31.7
50-84	344.9	30.1	3.3	236.0	75.5
Less than 50	958.0	42.3	11.9	676.4	227.4
All classes	1,458.7	111.2	16.7	987.0	343.8

Table 14.--Area of land by land class, Iowa, 1954 and 1974

(In thousand acres)

Land class	1954 [1/]	1974
Commercial forest land:	2,296.8	1,458.7
Noncommercial forest land:		
Unproductive	26.7	26.7
Productive-reserved	25.0	75.9
Subtotal	51.7	102.6
Nonforest land:	33,520.5	34,306.3
Total	35,869.0	35,867.6

[1/] Figures have been adjusted from those published previously for 1954 to conform to 1974 land classes because of changes in survey definitions.

Table 15.--Area of commercial forest land by forest type and ownership class, Iowa, 1974

(In thousand acres)

Forest type	All owners	Ownership class			
		Public	Forest industry	Farmer	Misc. private
Eastern redcedar-hardwood	34.9	--	.2	34.7	--
White oak-red oak-hickory	514.8	18.0	7.1	384.9	104.8
White oak	150.1	10.9	2.4	104.4	32.4
Bur oak	148.7	4.7	1.6	83.3	59.1
Elm-ash-cottonwood	404.1	68.6	3.4	242.6	89.5
Cottonwood	12.3	3.1	--	6.2	3.0
Hard maple-basswood	143.6	2.4	1.5	98.5	41.2
Aspen	7.8	--	--	7.8	--
Nonstocked	42.4	3.5	.5	24.6	13.8
All types	1,458.7	111.2	16.7	987.0	343.8

Table 16.--Area of commercial forest land by stand-volume class and ownership class, Iowa, 1974

(In thousand acres)

Stand volume per acre (board feet)[1/]	All owners	Ownership class			
		Public	Forest industry	Farmer	Misc. private
Less than 1,500	694.1	38.2	10.7	486.9	158.3
1,500-5,000	612.1	44.3	6.0	420.0	141.8
More than 5,000	152.5	28.7	--	80.1	43.7
All classes	1,458.7	111.2	16.7	987.0	343.8

[1/] International 1/4-inch rule.

Table 17.--Area of commercial forest land by forest type and site-index class, Iowa, 1974

(In thousand acres)

Forest types	All sites	Site-index class (Height in feet at 50 years)						
		31-40	41-50	51-60	61-70	71-80	81-90	91+
Eastern redcedar-hardwood	34.9	19.7	--	7.8	3.6	3.8	--	--
White oak-red oak-hickory	514.8	19.2	112.0	175.8	114.8	65.3	21.8	5.9
White oak	150.1	4.3	30.1	57.7	47.6	8.5	1.9	--
Bur oak	148.7	23.2	46.6	59.8	13.1	6.0	--	--
Elm-ash-cottonwood	404.1	2.9	24.7	77.9	100.2	108.8	40.4	49.2
Cottonwood	12.3	--	--	2.1	2.0	--	2.0	6.2
Hard maple-basswood	143.6	3.0	25.7	50.7	37.2	17.1	4.7	5.2
Aspen	7.8	--	--	--	--	5.2	2.6	--
Nonstocked	42.4	--	17.2	12.6	4.7	7.9	--	--
All types	1,458.7	72.3	256.3	444.4	323.2	222.6	73.4	66.5

Table 18.--Area of commercial forest land by forest type and stand-age class, Iowa, 1974

(In thousand acres)

Forest types	All ages	Stand-age class (years)											
		0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-119	120+
Eastern redcedar-hardwood	34.9	--	19.4	11.2	4.3	--	--	--	--	--	--	--	--
White oak-red oak-hickory	514.8	46.3	41.8	69.0	72.2	41.9	40.5	58.2	49.4	35.4	39.4	13.7	7.0
White oak	150.1	--	--	2.3	27.0	13.9	12.0	11.8	13.6	18.3	28.7	22.5	--
Bur oak	148.7	2.6	12.9	5.6	11.3	22.6	7.6	17.5	28.2	20.7	9.1	8.4	2.2
Elm-ash-cottonwood	404.1	29.1	52.9	46.0	61.6	73.2	50.0	26.8	18.1	22.5	21.2	2.7	--
Cottonwood	12.3	--	2.0	2.1	2.0	2.1	--	2.0	--	2.1	--	--	--
Hard maple-basswood	143.6	15.1	7.2	7.0	4.8	2.2	15.6	25.0	18.2	33.3	4.8	10.4	--
Aspen	7.8	--	2.6	--	--	--	2.6	--	2.6	--	--	--	--
Nonstocked	42.4	37.3	5.1	--	--	--	--	--	--	--	--	--	--
All types	1,458.7	130.4	143.9	143.2	183.2	155.9	128.3	141.3	130.1	132.3	103.2	57.7	9.2

Table 19.--Area of commercial forest land by forest type, stand-size class, and Forest Survey Unit, Iowa, 1974

(In thousand acres)

Forest type	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
NORTHEASTERN					
Eastern redcedar-hardwood	11.5	--	--	11.5	--
White oak-red oak-hickory	198.4	121.6	61.2	15.6	--
White oak	34.9	26.3	8.6	--	--
Bur oak	41.9	31.9	5.3	4.7	--
Elm-ash-cottonwood	155.1	103.7	35.6	15.8	--
Cottonwood	--	--	--	--	--
Hard maple-basswood	109.8	83.9	12.5	13.4	--
Aspen	7.8	7.8	--	--	--
Nonstocked	25.1	--	--	--	25.1
All types	584.5	375.2	123.2	61.0	25.1
SOUTHEASTERN					
Eastern redcedar-hardwood	10.6	--	--	10.6	--
White oak-red oak-hickory	272.6	96.1	95.0	81.5	--
White oak	107.1	67.5	39.6	--	--
Bur oak	62.0	38.9	6.6	16.5	--
Elm-ash-cottonwood	177.9	108.0	33.5	36.4	--
Cottonwood	--	--	--	--	--
Hard maple-basswood	18.8	6.3	4.7	7.8	--
Aspen	--	--	--	--	--
Nonstocked	10.4	--	--	--	10.4
All types	659.4	316.8	179.4	152.8	10.4
WESTERN					
Eastern redcedar-hardwood	12.8	--	--	12.8	--
White oak-red oak-hickory	43.8	9.2	12.7	21.9	--
White oak	8.1	--	8.1	--	--
Bur oak	44.8	19.2	25.6	--	--
Elm-ash-cottonwood	71.1	39.1	7.6	24.4	--
Cottonwood	12.3	12.3	--	--	--
Hard maple-basswood	15.0	9.6	--	5.4	--
Aspen	--	--	--	--	--
Nonstocked	6.9	--	--	--	6.9
All types	214.8	89.4	54.0	64.5	6.9
ALL UNITS					
Eastern redcedar-hardwood	34.9	--	--	34.9	--
White oak-red oak-hickory	514.8	226.9	168.9	119.0	--
White oak	150.1	93.8	56.3	--	--
Bur oak	148.7	90.0	37.5	21.2	--
Elm-ash-cottonwood	404.1	250.8	76.7	76.6	--
Cottonwood	12.3	12.3	--	--	--
Hard maple-basswood	143.6	99.8	17.2	26.6	--
Aspen	7.8	7.8	--	--	--
Nonstocked	42.4	--	--	--	42.4
All types	1,458.7	781.4	356.6	278.3	42.4

Table 20.--Area of commercial forest land by forest type and area-condition class, Iowa, 1974

(In thousand acres)

Forest type	All classes	Area-condition class					
		20	30	40	50	60	70
Eastern redcedar-hardwood	34.9	--	--	--	--	8.5	26.4
White oak-red oak-hickory	514.8	--	--	--	32.9	202.7	279.2
White oak	150.1	--	--	--	13.0	92.1	45.0
Bur oak	148.7	--	--	--	--	41.0	107.7
Elm-ash-cottonwood	404.1	--	--	--	37.7	103.7	262.7
Cottonwood	12.3	2.1	--	2.0	--	2.1	6.1
Hard maple-basswood	143.6	--	--	--	16.0	51.6	76.0
Aspen	7.8	--	--	--	--	--	7.8
Nonstocked	42.4	--	--	--	--	--	42.4
All types	1,458.7	2.1	--	2.0	99.6	501.7	853.3

Table 21.--Area of commercial forest land by type, stand-size class and site class, Iowa, 1974

(In thousand acres)

Forest type and stand-size class	All classes	Site class (cubic feet of growth/acre/year)					
		225+	165-225	120-165	85-120	50-85	Less than 50
Eastern redcedar-hardwood							
Sawtimber	--	--	--	--	--	--	--
Poletimber	--	--	--	--	--	--	--
Sapling and seedling	34.9	--	--	--	--	3.8	31.1
All stands	34.9	--	--	--	--	3.8	31.1
White oak-red oak-hickory							
Sawtimber	226.9	--	--	--	2.8	48.7	175.4
Poletimber	168.9	3.4	--	--	8.6	51.2	105.7
Sapling and seedling	119.0	--	--	--	3.1	24.5	91.4
All stands	514.8	3.4	--	--	14.5	124.4	372.5
White oak							
Sawtimber	93.8	--	--	--	--	15.1	78.7
Poletimber	56.3	--	--	--	--	12.7	43.6
Sapling and seedling	--	--	--	--	--	--	--
All stands	150.1	--	--	--	--	27.8	122.3
Bur oak							
Sawtimber	90.0	--	--	--	--	8.7	81.3
Poletimber	37.5	--	--	--	--	4.8	32.7
Sapling and seedling	21.2	--	--	--	--	2.6	18.6
All stands	148.7	--	--	--	--	16.1	132.6
Elm-ash-cottonwood							
Sawtimber	250.8	--	--	19.0	50.8	86.6	94.4
Poletimber	76.7	--	--	5.9	14.3	24.2	32.3
Sapling and seedling	76.6	--	--	5.3	16.3	10.1	44.9
All stands	404.1	--	--	30.2	81.4	120.9	171.6
Cottonwood							
Sawtimber	12.3	--	--	4.1	4.1	2.0	2.1
Poletimber	--	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	--	--	--
All stands	12.3	--	--	4.1	4.1	2.0	2.1
Hard maple-basswood							
Sawtimber	99.8	--	--	3.0	7.4	25.2	64.2
Poletimber	17.2	--	--	--	2.5	4.8	9.9
Sapling and seedling	26.6	--	--	--	--	4.5	22.1
All stands	143.6	--	--	3.0	9.9	34.5	96.2
Aspen							
Sawtimber	7.8	--	--	--	5.2	--	2.6
Poletimber	--	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	--	--	--
All stands	7.8	--	--	--	5.2	--	2.6
Nonstocked	42.4	--	--	--	--	15.4	27.0
All types							
Sawtimber	781.4	--	--	26.1	70.3	186.3	498.7
Poletimber	356.6	3.4	--	5.9	25.4	97.7	224.2
Sapling and seedling	278.3	--	--	5.3	19.4	45.5	208.1
Nonstocked	42.4	--	--	--	--	15.4	27.0
All stands	1,458.7	3.4	--	37.3	115.1	344.9	958.0

Table 22.--Area of commercial forest land by forest type and basal area class, Iowa, 1974

(In thousand acres)

Forest type	All classes	Basal area class (square feet per acre) 0-19	20-39	40-59	60-79	80-99	100-119	120-139	140-159	160-179	180+
Eastern redcedar-hardwood	34.9	4.3	11.3	7.7	11.6	--	--	--	--	--	--
White oak-red oak-hickory	514.8	15.5	82.7	135.7	127.2	84.2	60.6	8.9	--	--	--
White oak	150.1	--	2.6	36.6	44.7	33.3	19.3	11.4	2.2	--	--
Bur oak	148.7	--	8.3	58.4	47.2	27.2	4.4	3.2	--	--	--
Elm-ash-cottonwood	404.1	18.2	73.9	88.7	75.0	64.9	54.1	18.9	5.2	5.2	--
Cottonwood	12.3	--	--	2.0	6.2	--	--	--	--	4.1	--
Hard maple-basswood	143.6	12.8	16.4	25.7	22.5	29.1	22.8	9.9	2.2	2.2	--
Aspen	7.8	--	--	7.8	--	--	--	--	--	--	--
Nonstocked	42.4	--	17.2	10.3	7.4	2.4	5.1	--	--	--	--
All types	1,458.7	50.8	212.4	372.9	341.8	241.1	166.3	52.3	9.6	11.5	--

Table 23.--Area of commercial forest land by stocking class based on selected stand components, Iowa, 1974

(In thousand acres)

Stocking percentage	All live trees	Growing-stock trees Total	Desirable	Acceptable	Rough and rotten trees
160+	203.1	8.2	--	8.2	199.0
150-159	2.3	--	--	--	2.3
140-149	633.9	38.8	--	38.8	631.6
130-139	39.7	20.0	--	20.0	2.2
120-129	68.1	4.5	--	--	4.9
110-119	98.8	18.9	--	7.3	10.0
100-109	86.4	20.3	--	9.5	13.2
90-99	98.1	35.1	--	20.4	7.6
80-89	72.0	80.1	--	69.4	19.1
70-79	68.9	50.0	--	48.5	31.3
60-69	38.4	68.4	--	68.6	39.3
50-59	25.9	71.4	2.3	88.7	74.3
40-49	18.3	174.5	7.4	192.6	116.4
30-39	--	98.1	11.7	102.8	131.8
20-29	--	81.1	27.9	88.8	75.6
10-19	4.8	29.0	46.7	34.8	62.9
Less than 10	--	660.3	1,362.7	660.3	37.2
Total	1,458.7	1,458.7	1,458.7	1,458.7	1,458.7

Table 24.--Area of commercial forest land by stocking class of growing-stock trees and stand-size class, Iowa, 1974

(In thousand acres)

Stocking percentage	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
Less than 17	675.1	239.0	188.8	204.9	42.4
18-60	439.2	277.3	88.5	73.4	--
61-100	233.7	179.0	54.7	--	--
101-133	43.6	26.9	16.7	--	--
134+	67.1	59.2	7.9	--	--
All classes	1,458.7	781.4	356.6	278.3	42.4

Table 25.--Area of noncommercial forest land by forest type, Iowa, 1974

(In thousand acres)

Forest type	All areas	Productive-reserved areas	Unproductive areas
Christmas tree plantation	0.2	0.2	--
Eastern redcedar-hardwood	5.5	--	5.5
White oak-red oak-hickory	67.6	46.4	21.2
Elm-ash-cottonwood	29.0	29.0	--
Hard maple-basswood	0.3	0.3	--
All types	102.6	75.9	26.7

Table 26.--Area of noncommercial forest land by ownership class, Iowa, 1974

(In thousand acres)

Ownership class	All areas	Productive-reserved areas	Unproductive areas
Federal	34.3	34.3	--
State	20.2	20.2	--
County and municipal	21.4	21.4	--
Forest industry	--	--	--
Farmer	26.7	--	26.7
Miscellaneous private			
Individual	--	--	--
Corporate	--	--	--
All owners	102.6	75.9	26.7

Table 27.--Number of all live trees on commercial forest land by species and diameter class, Iowa, 1974

(In thousand trees)

Species	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:															
White and red pine	9	--	--	--	--	--	--	--	9	--	--	--	--	--	--
Eastern redcedar	13,160	7,556	3,160	1,168	728	325	145	53	16	9	--	--	--	--	--
Other softwoods	99	--	65	34	--	--	--	--	--	--	--	--	--	--	--
Total	13,268	7,556	3,225	1,202	728	325	145	53	25	9	--	--	--	--	--
Hardwoods:															
Select white oaks	54,411	13,613	11,274	7,944	7,300	4,650	2,851	2,486	1,686	1,108	613	373	409	104	--
Select red oaks	18,084	3,314	2,993	2,020	2,549	2,000	1,658	1,245	791	544	384	235	273	73	5
Other white oaks	634	303	--	172	101	18	--	22	9	6	--	3	--	--	--
Other red oaks	15,933	4,733	3,435	2,841	1,643	1,186	953	494	228	224	77	40	51	26	2
Hickory	72,068	38,738	18,374	7,525	3,494	1,832	1,140	511	267	127	37	5	15	3	--
Hard maple	11,837	5,577	1,791	1,540	790	649	406	411	204	224	99	43	92	11	--
Soft maple	32,721	13,099	9,355	3,131	2,228	1,458	1,366	818	415	252	182	150	146	106	15
Ash	22,295	13,925	2,747	2,254	1,483	785	386	234	160	83	99	64	53	22	--
Cottonwood	3,732	203	465	646	332	358	418	273	250	159	174	112	211	97	34
Aspen	10,422	5,334	2,454	998	601	533	373	72	14	23	9	8	3	--	--
Basswood	26,054	12,427	5,371	2,558	1,720	1,427	736	725	457	272	136	112	97	15	1
Elm	90,002	54,510	17,520	8,481	4,312	2,068	1,101	735	505	307	190	112	129	27	5
Black walnut	10,554	3,449	2,172	1,485	1,453	861	470	329	181	75	51	19	9	--	--
Black cherry	11,160	4,102	3,429	1,873	855	375	271	154	50	40	9	--	--	2	--
Hackberry	18,084	10,643	4,652	1,327	557	498	133	84	63	37	26	13	41	7	3
Willow	19,142	10,451	3,062	2,376	1,269	697	471	327	237	140	55	35	22	--	--
Birch	4,492	2,442	395	545	299	310	164	219	59	22	23	3	9	2	--
Other hardwoods	29,595	12,562	6,336	4,149	2,816	1,864	795	447	305	131	81	30	52	23	4
Noncommercial species	103,215	85,436	13,982	3,155	536	102	--	--	--	--	4	--	--	--	--
Total	554,435	294,861	109,807	55,020	34,338	21,671	13,692	9,586	5,881	3,774	2,249	1,357	1,612	518	69
All species	567,703	302,417	113,032	56,222	35,066	21,996	13,837	9,639	5,906	3,783	2,249	1,357	1,612	518	69

Table 28.--Number of growing-stock trees on commercial forest land by species and diameter class, Iowa, 1974

(In thousand trees)

Species	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:															
White and red pine	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Eastern redcedar	8,672	5,887	1,377	674	515	89	74	39	8	9	--	--	--	--	--
Other softwoods	99	--	64	35	--	--	--	--	--	--	--	--	--	--	--
Total	8,771	5,887	1,441	709	515	89	74	39	8	9	--	--	--	--	--
Hardwoods:															
Select white oaks	34,754	5,233	7,747	5,933	5,742	3,361	1,985	1,936	1,236	719	394	192	241	35	--
Select red oaks	12,879	1,858	2,565	1,437	2,039	1,334	1,122	964	568	421	248	150	145	27	1
Other white oaks	264	--	--	113	101	19	--	22	--	6	--	3	--	--	--
Other red oaks	9,602	2,680	2,089	1,608	1,068	866	617	342	108	127	40	20	24	11	2
Hickory	52,068	25,174	14,228	6,360	3,031	1,589	949	416	200	83	32	--	6	--	--
Hard maple	8,757	3,730	1,698	1,133	680	537	251	314	174	117	59	18	45	1	--
Soft maple	20,951	7,847	5,951	2,082	1,468	1,150	926	640	285	190	164	94	91	56	7
Ash	14,636	8,676	1,822	1,790	973	606	331	151	116	48	64	25	24	10	--
Cottonwood	3,336	203	465	439	251	344	392	273	242	158	171	109	194	75	20
Aspen	5,083	2,184	898	821	402	358	314	54	14	23	9	3	3	--	--
Basswood	15,256	6,815	3,247	1,578	1,015	1,026	442	487	352	163	54	42	29	6	--
Elm	49,443	25,745	12,065	5,280	2,898	1,551	689	483	304	202	84	62	67	12	1
Black walnut	6,736	869	1,925	1,284	1,148	612	354	309	146	46	32	11	--	--	--
Black cherry	6,071	2,816	1,508	819	495	145	183	87	14	--	4	--	--	--	--
Hackberry	12,115	6,119	3,951	987	423	341	109	54	39	27	16	14	33	2	--
Willow	8,679	3,305	1,784	1,368	802	619	358	202	130	69	23	7	12	--	--
Birch	1,929	636	73	356	220	252	138	148	54	22	18	4	8	--	--
Other hardwoods	7,365	1,786	2,939	864	832	568	109	107	80	40	18	8	11	3	--
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	269,924	105,676	64,955	34,252	23,588	15,278	9,269	6,989	4,062	2,461	1,430	762	93	23	31
All species	278,695	111,563	66,396	34,961	24,103	15,367	9,343	7,028	4,070	2,470	1,430	762	933	238	31

Table 29.--Number of growing-stock trees on commercial forest land by softwoods and hardwoods, diameter class, and Forest Survey Unit, Iowa, 1974

(In thousand trees)

Species group	All classes	1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
						NORTHEASTERN									
						Diameter class (inches at breast height)									
Softwoods	5,266	3,952	782	435	62	35	--	--	--	--	--	--	--	--	--
Hardwoods	98,312	36,913	21,250	12,361	8,707	6,856	4,446	3,409	1,924	1,149	571	335	327	58	6
All species	103,578	40,865	22,032	12,796	8,769	6,891	4,446	3,409	1,924	1,149	571	335	327	58	6
						SOUTHEASTERN									
Softwoods	1,264	656	105	135	225	54	56	25	8	--	--	--	--	--	--
Hardwoods	136,358	54,172	35,269	17,433	11,337	6,838	4,115	2,938	1,702	1,068	636	319	410	112	9
All species	137,622	54,828	35,374	17,568	11,562	6,892	4,171	2,963	1,710	1,068	636	319	410	112	9
						WESTERN									
Softwoods	2,241	1,279	554	139	228	--	18	14	--	9	--	--	--	--	--
Hardwoods	35,254	14,591	8,436	4,458	3,544	1,584	708	642	436	244	223	108	196	68	16
All species	37,495	15,870	8,990	4,597	3,772	1,584	726	656	436	253	223	108	196	68	16
						ALL UNITS									
Softwoods	8,771	5,887	1,441	709	515	89	74	39	8	9	--	--	--	--	--
Hardwoods	269,924	105,676	64,955	34,252	23,588	15,278	9,269	6,989	4,062	2,461	1,430	762	933	238	31
All species	278,695	111,563	66,396	34,961	24,103	15,367	9,343	7,028	4,070	2,470	1,430	762	933	238	31

Table 30.--Number of short-log trees on commercial forest land by species and diameter class, Iowa, 1974

(In thousand trees)

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White and red pine	--	--	--	--	--	--	--	--	--	--	--
Eastern redcedar	158	158	--	--	--	--	--	--	--	--	--
Other softwoods	--	--	--	--	--	--	--	--	--	--	--
Total	158	158	--	--	--	--	--	--	--	--	--
Hardwoods:											
Select white oaks	1,287	--	522	237	143	200	65	61	45	14	--
Select red oaks	248	--	98	50	16	30	21	13	11	8	1
Other white oaks	--	--	--	--	--	--	--	--	--	--	--
Other red oaks	222	--	76	60	29	35	5	7	4	6	--
Hickory	166	--	96	31	16	23	--	--	--	--	--
Hard maple	134	--	40	48	--	35	5	--	6	--	--
Soft maple	322	--	141	59	47	34	4	16	9	11	1
Ash	78	--	42	--	--	17	4	8	3	4	--
Cottonwood	23	--	15	--	--	--	--	--	2	4	2
Aspen	--	--	--	--	--	--	--	--	--	--	--
Basswood	181	--	101	37	7	12	19	4	1	--	--
Elm	483	--	202	121	86	40	16	7	9	2	--
Black walnut	122	--	64	21	18	5	9	5	--	--	--
Black cherry	29	--	12	--	--	17	--	--	--	--	--
Hackberry	46	--	24	12	7	--	--	--	--	--	3
Willow	112	--	--	51	36	11	--	9	5	--	--
Birch	7	--	--	7	--	--	--	--	--	--	--
Other hardwoods	133	--	73	38	12	--	4	3	3	--	--
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--
Total	3,593	--	1,506	772	417	459	152	133	98	49	7
All species	3,751	158	1,506	772	417	459	152	133	98	49	7

Table 31.--Net volume of growing stock and sawtimber on commercial forest land by softwoods and hardwoods, Iowa, 1954 and 1974

Species group	Growing stock		Sawtimber	
	1954[1]	1974	1954[1]	1974
	Million cubic feet		Million board feet[2]	
Softwoods	3.7	5.8	6.0	11.5
Hardwoods	1,345.1	1,048.9	4,946.0	3,475.0
All species	1,348.8	1,054.7	4,952.0	3,486.5

[1] Figures have been adjusted from those published previously for 1954 to conform to 1974 because of changes in survey definitions.

[2] International 1/4-inch rule.

Table 32.--Net volume of growing stock on commercial forest land by species and diameter class, Iowa, 1974

(In million cubic feet)

Species	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:													
White and red pine	--	--	--	--	--	--	--	--	--	--	--	--	--
Eastern redcedar	5.7	1.3	2.0	0.7	0.7	0.6	0.2	0.2	--	--	--	--	--
Other softwoods	0.1	0.1	--	--	--	--	--	--	--	--	--	--	--
Total	5.8	1.4	2.0	0.7	0.7	0.6	0.2	0.2	--	--	--	--	--
Hardwoods:													
Select white oaks	231.7	13.8	27.5	27.9	25.9	36.7	31.1	23.4	15.7	9.4	15.9	4.4	--
Select red oaks	126.3	4.0	10.7	12.2	15.3	18.7	15.7	15.4	11.2	8.3	11.1	3.1	0.6
Other white oaks	1.6	0.3	0.4	0.1	--	0.4	--	0.2	--	0.2	--	--	--
Other red oaks	43.2	3.3	5.0	7.4	7.8	6.3	2.8	4.2	1.8	1.0	1.6	1.5	0.5
Hickory	78.7	16.0	15.8	15.2	13.5	8.3	5.4	2.6	1.4	--	0.5	--	--
Hard maple	38.3	3.3	3.8	5.0	3.6	6.4	4.8	4.2	2.5	1.2	3.3	0.2	--
Soft maple	109.5	5.8	8.9	12.1	15.2	15.2	10.1	9.0	9.5	6.1	7.6	8.1	1.9
Ash	35.3	4.3	5.1	5.3	4.7	3.0	3.2	2.2	3.1	1.6	1.9	0.9	--
Cottonwood	91.7	1.5	1.5	3.6	6.8	6.8	8.1	7.0	9.7	8.1	20.3	12.8	5.5
Aspen	17.4	2.2	3.0	3.7	5.0	1.2	0.4	1.0	0.4	0.2	0.3	--	--
Basswood	57.7	3.6	5.3	9.6	6.6	9.8	9.5	5.9	2.5	2.1	2.0	0.8	--
Elm	95.4	12.8	16.9	14.2	10.1	9.8	8.4	8.0	4.0	4.0	5.3	1.6	0.3
Black walnut	31.8	3.0	5.9	5.3	4.7	5.8	3.5	1.4	1.6	0.6	--	--	--
Black cherry	11.5	2.1	2.6	1.5	2.8	1.9	0.4	--	0.2	--	--	--	--
Hackberry	15.9	2.1	2.1	2.7	1.6	1.2	1.0	0.9	0.8	0.7	2.6	0.2	--
Willow	31.0	3.3	4.4	5.8	5.1	4.3	3.3	2.7	1.0	0.4	0.7	--	--
Birch	14.1	0.9	1.4	2.3	2.1	3.1	1.7	0.9	0.8	0.2	0.7	--	--
Other hardwoods	17.8	1.8	3.4	3.9	1.3	1.8	2.1	1.0	0.8	0.5	0.9	0.3	--
Total	1,048.9	84.1	123.7	137.8	132.1	140.7	111.5	90.0	67.0	44.6	74.7	33.9	8.8
All species	1,054.7	85.5	125.7	138.5	132.8	141.3	111.7	90.2	67.0	44.6	74.7	33.9	8.8

Table 33.--Net volume of sawtimber on commercial forest land by species and diameter class, Iowa, 1974

(In million board feet)[1/]

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White and red pine	--	--	--	--	--	--	--	--	--	--	--
Eastern redcedar	11.5	3.8	2.9	2.3	1.1	1.4	--	--	--	--	--
Other softwoods	--	--	--	--	--	--	--	--	--	--	--
Total	11.5	3.8	2.9	2.3	1.1	1.4	--	--	--	--	--
Hardwoods:											
Select white oaks	812.4	--	129.2	182.0	156.1	116.3	82.3	48.9	81.1	16.5	--
Select red oaks	511.2	--	79.1	99.6	80.4	75.0	60.8	42.6	56.4	15.6	1.7
Other white oaks	4.7	--	--	2.4	--	1.4	--	0.9	--	--	--
Other red oaks	144.2	--	42.0	33.3	14.3	22.3	8.4	5.4	8.4	8.4	1.7
Hickory	[illegible].5	--	71.3	42.4	27.3	14.8	6.8	--	1.9	--	--
Hard maple	137.0	--	21.9	36.1	24.0	23.0	11.9	5.0	14.6	0.5	--
Soft maple	361.7	--	65.4	70.1	44.8	39.3	42.6	27.2	35.5	31.9	4.9
Ash	99.1	--	19.9	14.9	17.6	9.7	15.6	7.5	9.9	4.0	--
Cottonwood	436.4	--	31.9	35.3	40.7	36.9	53.3	42.4	105.2	63.9	26.8
Aspen	37.6	--	21.8	4.7	2.3	4.7	1.8	1.1	1.2	--	--
Basswood	199.4	--	32.7	52.9	48.8	30.6	10.9	10.5	9.7	3.3	--
Elm	243.2	--	48.7	46.9	42.0	36.6	19.0	18.6	24.7	5.9	0.8
Black walnut	88.3	--	22.6	28.5	18.6	8.7	7.2	2.7	--	--	--
Black cherry	23.6	--	12.7	8.4	1.6	--	0.9	--	--	--	--
Hackberry	43.2	--	9.4	6.0	4.9	4.5	3.7	2.9	11.2	0.6	--
Willow	82.0	--	23.9	20.2	16.1	11.9	5.2	1.6	3.1	--	--
Birch	43.4	--	9.1	15.0	7.7	4.0	3.4	0.9	3.3	--	--
Other hardwoods	43.1	--	6.5	8.9	10.9	5.6	3.8	1.6	4.4	1.4	--
Total	3,475.0	--	648.1	707.6	558.1	445.3	337.6	219.8	370.6	152.0	35.9
All species	3,486.5	3.8	651.0	709.9	559.2	446.7	337.6	219.8	370.6	152.0	35.9

[1/] International 1/4-inch rule.

Table 34.--Net volume of short-log trees on commercial forest land by species and diameter class, Iowa, 1974

(In million board feet)[1/]

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White and red pine	--	--	--	--	--	--	--	--	--	--	--
Eastern redcedar	4.4	4.4	--	--	--	--	--	--	--	--	--
Other softwoods	--	--	--	--	--	--	--	--	--	--	--
Total	4.4	4.4	--	--	--	--	--	--	--	--	--
Hardwoods:											
Select white oaks	82.7	--	16.3	11.2	10.6	17.8	7.3	8.3	8.3	2.9	--
Select red oaks	17.0	--	3.8	2.8	1.0	2.7	1.9	1.5	1.7	1.4	0.2
Other white oaks	--	--	--	--	--	--	--	--	--	--	--
Other red oaks	14.0	--	3.1	3.2	1.8	2.7	0.4	0.8	0.6	1.4	--
Hickory	8.0	--	3.7	1.7	0.9	1.7	--	--	--	--	--
Hard maple	10.0	--	2.1	2.8	--	3.1	0.6	--	1.4	--	--
Soft maple	19.1	--	5.9	3.3	2.9	2.7	0.4	1.4	1.1	1.2	0.2
Ash	6.2	--	1.7	--	--	1.2	0.4	0.9	0.5	1.5	--
Cottonwood	3.1	--	0.7	--	--	--	--	--	0.5	0.7	1.2
Aspen	--	--	--	--	--	--	--	--	--	--	--
Basswood	7.3	--	3.0	0.2	0.3	0.1	1.5	1.2	1.0	--	--
Elm	25.1	--	7.5	5.6	5.7	2.9	1.5	0.5	1.0	0.4	--
Black walnut	6.6	--	2.3	1.2	1.4	.4	0.9	0.4	--	--	--
Black cherry	1.6	--	0.3	--	--	1.3	--	--	--	--	--
Hackberry	3.7	--	0.9	0.6	0.5	--	--	--	--	--	1.7
Willow	4.9	--	--	2.2	1.4	1.3	--	--	--	--	--
Birch	0.2	--	--	0.2	--	--	--	--	--	--	--
Other hardwoods	6.4	--	3.2	1.6	0.7	--	0.4	0.2	0.3	--	--
Total	215.9	--	54.5	36.6	27.2	37.9	15.3	15.2	16.4	9.5	3.3
All species	220.3	4.4	54.5	36.6	27.2	37.9	15.3	15.2	16.4	9.5	3.3

[1/] International 1/4-inch rule.

Table 35.--Net volume of growing stock on commercial forest land by species and forest type, Iowa, 1974

(In million cubic feet)

Species	All types	Forest types							
		Eastern redcedar-hardwood	White oak-red oak-hickory	White oak	Bur oak	Elm-ash-cotton-wood	Cotton-wood	Sugar maple-basswood	Aspen
Softwoods:									
White and red pine	--	--	--	--	--	--	--	--	--
Eastern redcedar	5.7	3.8	0.6	0.4	0.5	--	--	0.4	--
Other softwoods	0.1	--	0.1	--	--	--	--	--	--
Total	5.8	3.8	0.7	0.4	0.5	--	--	0.4	--
Hardwoods:									
Select white oaks	231.7	1.2	63.4	91.0	56.5	11.3	--	8.1	0.2
Select red oaks	126.3	--	93.6	12.2	2.7	3.1	--	14.5	0.2
Other white oaks	1.6	--	0.5	1.0	0.1	--	--	--	--
Other red oaks	43.2	0.5	27.6	10.2	3.6	1.2	--	0.1	--
Hickory	78.7	0.8	58.4	7.2	3.5	3.5	--	5.3	--
Hard maple	38.3	--	11.4	0.6	--	2.2	--	24.1	--
Soft maple	109.5	--	0.5	0.7	1.7	106.4	--	0.2	--
Ash	35.3	0.4	8.4	2.8	0.7	20.3	--	2.7	--
Cottonwood	91.7	0.7	2.7	--	0.8	60.5	26.8	0.2	--
Aspen	17.4	--	7.0	1.1	0.4	4.0	--	2.3	2.6
Basswood	57.7	0.3	12.7	3.5	3.0	4.2	--	34.0	--
Elm	95.4	--	24.8	5.8	7.4	33.2	0.2	23.8	0.2
Black walnut	31.8	0.6	8.9	3.0	2.1	13.0	0.6	3.6	--
Black cherry	11.5	--	6.0	0.8	0.2	3.5	--	0.8	0.2
Hackberry	15.9	--	2.1	0.2	1.4	11.3	0.1	0.8	--
Willow	31.0	--	--	--	0.2	30.7	0.1	--	--
Birch	14.1	0.7	1.7	--	0.2	10.9	--	0.6	--
Other hardwoods	17.8	--	4.8	0.4	1.0	9.0	0.6	2.0	--
Total	1,048.9	5.2	334.5	140.5	85.5	328.3	28.4	123.1	3.4
All species	1,054.7	9.0	335.2	140.9	86.0	328.3	28.4	123.5	3.4

Table 36.--Net volume of sawtimber on commercial forest land by species and forest type, Iowa, 1974

(In million board feet)[1/]

Species	All types	Forest types: Eastern redcedar-hardwood	White oak-red oak-hickory	White oak	Bur Oak	Elm-ash-cotton-wood	Cotton wood	Sugar maple-basswood	Aspen
Softwoods:									
White and red pine	--	--	--	--	--	--	--	--	--
Eastern redcedar	11.5	6.6	2.1	1.5	1.3	--	--	--	--
Other softwoods	--	--	--	--	--	--	--	--	--
Total	11.5	6.6	2.1	1.5	1.3	--	--	--	--
Hardwoods:									
Select white oaks	812.4	4.3	202.8	322.5	202.6	47.5	--	31.5	1.2
Select red oaks	511.2	--	375.4	48.4	10.2	13.4	--	62.5	1.3
Other white oaks	4.7	--	1.4	2.6	0.7	--	--	--	--
Other red oaks	144.2	--	90.1	36.8	12.6	4.7	--	--	--
Hickory	164.5	--	112.4	18.5	10.1	11.1	--	12.4	--
Hard maple	137.0	--	37.6	0.7	--	9.6	--	89.1	--
Soft maple	361.7	--	0.9	2.5	4.1	353.6	--	0.6	--
Ash	99.1	0.6	14.4	2.8	1.5	73.1	--	6.7	--
Cottonwood	436.4	1.8	12.4	--	3.4	284.3	133.3	1.2	--
Aspen	37.6	--	13.9	2.8	--	12.0	--	2.0	6.9
Basswood	199.4	--	39.0	6.7	8.3	16.1	--	129.3	--
Elm	243.2	--	62.3	8.8	17.8	81.7	--	71.4	1.2
Black walnut	88.3	2.4	27.4	4.2	5.0	34.4	.7	14.2	--
Black cherry	23.6	--	8.6	1.4	0.8	9.5	--	2.3	1.0
Hackberry	43.2	--	4.8	--	3.9	33.3	--	1.2	--
Willow	82.0	--	--	--	0.9	81.1	--	--	--
Birch	43.4	2.6	4.1	--	--	35.3	--	1.4	--
Other hardwoods	43.1	--	7.9	1.3	1.2	24.5	1.7	6.5	--
Total	3,475.0	11.7	1,015.4	460.0	283.1	1,125.2	135.7	432.3	11.6
All species	3,486.5	18.3	1,017.5	461.5	284.4	1,125.2	135.7	432.3	11.6

[1/] International 1/4-inch rule.

Table 37.--Net volume of growing stock on commercial forest land by species and Forest Survey Unit, Iowa, 1974

(In million cubic feet)

Species	All units	North-eastern	South-eastern	Western
Softwoods:				
White and red pine	--	--	--	--
Eastern redcedar	5.7	1.1	2.7	1.9
Other softwoods	0.1	0.1	--	--
Total	5.8	1.2	2.7	1.9
Hardwoods:				
Select white oaks	231.7	71.0	129.0	31.7
Select red oaks	126.3	64.5	57.8	4.0
Other white oaks	1.6	0.3	1.3	--
Other red oaks	43.2	16.4	26.5	0.3
Hickory	78.7	27.5	42.1	9.1
Hard maple	38.3	34.1	4.2	--
Soft maple	109.5	33.4	66.5	9.6
Ash	35.3	16.9	11.1	7.3
Cottonwood	91.7	22.2	34.1	35.4
Aspen	17.4	15.5	1.9	--
Basswood	57.7	36.7	16.9	4.1
Elm	95.4	66.5	16.3	12.6
Black walnut	31.8	16.5	10.8	4.5
Black cherry	11.5	8.5	2.6	0.4
Hackberry	15.9	2.7	10.5	2.7
Willow	31.0	10.8	12.0	8.2
Birch	14.1	10.8	3.3	--
Other hardwoods	17.8	4.5	12.1	1.2
Total	1,048.9	458.8	459.0	131.1
All species	1,054.7	460.0	461.7	133.0

Table 38.--Net volume of sawtimber on commercial forest land by species and Forest Survey Unit, Iowa, 1974

(In million board feet)[1/]

Species	All units	North-eastern	South-eastern	Western
Softwoods:				
White and red pine	--	--	--	--
Eastern redcedar	11.5	1.3	6.8	3.4
Other softwoods	--	--	--	--
Total	11.5	1.3	6.8	3.4
Hardwoods:				
Select white oaks	812.4	275.8	442.3	94.3
Select red oaks	511.2	275.3	220.2	15.7
Other white oaks	4.7	1.4	3.3	--
Other red oaks	144.2	61.2	83.0	--
Hickory	164.5	67.3	79.6	17.6
Hard maple	137.0	121.9	15.1	--
Soft maple	361.7	101.6	224.1	36.0
Ash	99.1	50.8	26.1	22.2
Cottonwood	436.4	102.8	162.9	170.7
Aspen	37.6	29.7	7.9	--
Basswood	199.4	132.8	46.9	19.7
Elm	243.2	170.4	34.0	38.8
Black walnut	88.3	47.4	29.8	11.1
Black cherry	23.6	19.7	3.9	--
Hackberry	43.2	5.4	32.5	5.3
Willow	82.0	34.6	36.2	11.2
Birch	43.4	31.9	11.5	--
Other hardwoods	43.1	8.9	31.5	2.7
Total	3,475.0	1,538.9	1,490.8	445.3
All species	3,486.5	1,540.2	1,497.6	448.7

[1/] International 1/4-inch rule.

Table 39.--Net volume of growing stock, sawtimber, and rough and rotten trees on commercial forest land by individual species, Iowa, 1974

Species	Growing stock	Rough and rotten trees[1]	Sawtimber
	Million cubic feet		Million board feet[2]
Softwoods:			
Eastern white pine	--	--	--
Red pine	--	--	--
Eastern redcedar	5.7	3.9	11.5
Balsam fir	0.1	--	--
Total	5.8	3.9	11.5
Hardwoods:			
Select white oaks			
White oak	148.3	29.8	515.6
Swamp white oak	4.7	1.0	15.6
Bur oak	77.8	44.9	278.4
Chinkapin oak	0.9	0.4	2.8
Select red oaks			
Northern red oak	126.3	23.9	511.2
Other white oaks			
Overcup oak	0.4	--	2.1
Post oak	1.2	0.2	2.6
Other red oaks			
Northern pin oak	6.0	2.3	26.4
Shingle oak	3.2	2.0	5.2
Pin oak	4.8	1.4	15.6
Black oak	29.2	11.0	97.0
Bitternut hickory	18.1	3.3	37.9
Shellbark hickory	0.4	--	0.7
Shagbark hickory	59.0	7.3	121.3
Mockernut hickory	1.2	--	4.6
Hard maple			
Black maple	13.0	2.6	36.9
Sugar maple	25.3	6.9	100.1
Soft maple			
Silver maple	109.5	29.1	361.7
White ash	10.1	2.6	15.5
Black ash	1.5	--	3.7
Green ash	23.7	6.3	79.9
Eastern cottonwood	91.7	6.1	436.4
Bigtooth aspen	7.9	0.8	14.8
Quaking aspen	9.5	1.6	22.8
American basswood	57.7	11.9	199.4
American elm	58.5	32.7	145.9
Slippery elm	36.7	8.6	96.6
Rock elm	0.2	0.1	0.7
Black walnut	31.8	6.3	88.3
Black cherry	11.5	8.1	23.6
Hackberry	15.9	4.7	43.2
Black willow	31.0	8.1	82.0
River birch	12.1	1.8	40.4
Paper birch	2.0	1.0	3.0
Other hardwoods			
Boxelder	5.0	17.0	7.9
Ohio buckeye	1.5	0.3	4.0
Honeylocust	5.0	8.3	14.2
Kentucky coffeetree	0.4	0.4	0.9
Butternut	2.6	1.3	7.1
Osage-orange	0.3	0.8	--
Red mulberry	0.2	1.6	--
American sycamore	2.2	0.4	9.0
Black locust	0.6	1.1	--
Noncommercial species	--	6.0	--
Total	1,048.9	304.0	3,475.0
Total all species	1,054.7	307.9	3,486.5

[1] Includes short-log trees.
[2] International 1/4-inch rule.

Table 40.--Net volume of growing stock and sawtimber on commercial forest land by ownership class and species group, Iowa, 1974

Ownership class	All species	Softwoods	Oaks	Other hardwoods
	GROWING STOCK			
	----------Million cubic feet----------			
Public	120.2	--	26.3	93.9
Forest industry	12.0	--	4.6	7.4
Farmer	660.1	5.1	265.1	389.9
Miscellaneous private	262.4	0.7	106.8	154.9
All ownerships	1,054.7	5.8	402.8	646.1
	SAWTIMBER			
	----------Million board feet[1/]----------			
Public	383.3	--	94.2	289.1
Forest industry	39.1	--	16.6	22.5
Farmer	2,194.0	11.5	996.0	1,186.5
Miscellaneous private	870.1	--	365.7	504.4
All ownerships	3,486.5	11.5	1,472.5	2,002.5

[1/] International 1/4-inch rule.

Table 41.--Net volume of timber on commercial forest land by class of timber and softwoods and hardwoods, Iowa, 1974

(In million cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Growing-stock trees:			
Sawtimber trees:			
Saw-log portion	478.7	1.7	477.0
Upper-stem portion	227.0	0.7	226.3
Total sawtimber	705.7	2.4	703.3
Poletimber trees	349.0	3.4	345.6
Total growing stock	1,054.7	5.8	1,048.9
Cull trees:			
Rough and rotten cull trees	225.8	2.9	222.9
Short-log cull trees	82.1	1.0	81.1
Total cull trees	307.9	3.9	304.0
Salvable dead trees	0.5	--	0.5
All timber	1,363.1	9.7	1,353.4

Table 42.--Net volume of sawtimber on commercial forest land by species and log grade class, Iowa, 1974

(In million board feet)[1/]

Species	All grades	Log grade			
		1	2	3	Tie & timber
Softwoods:					
White and red pine	--	--	--	--	--
Eastern redcedar	11.5	--	1.2	10.3	--
Other softwoods	--	--	--	--	--
Total	11.5	--	1.2	10.3	--
Hardwoods:					
Select white oaks	812.4	83.7	196.0	398.1	134.6
Select red oaks	511.2	90.0	191.4	189.2	40.6
Other white oaks	4.7	0.3	1.6	2.7	0.1
Other red oaks	144.2	8.3	34.5	71.4	30.0
Hickory	164.5	9.2	36.9	80.8	37.6
Hard maple	137.0	26.5	33.4	66.1	11.0
Soft maple	361.7	58.2	104.0	177.9	21.6
Ash	99.1	4.0	49.8	41.3	4.0
Cottonwood	436.4	91.3	90.1	245.6	9.4
Aspen	37.6	1.7	5.0	30.3	0.6
Basswood	199.4	51.2	81.4	55.4	11.4
Elm	243.2	35.7	99.0	85.2	23.3
Black walnut	88.3	6.7	29.4	50.1	2.1
Black cherry	23.6	0.4	5.8	11.8	5.6
Hackberry	43.2	3.4	16.8	22.7	0.3
Willow	82.0	2.8	13.8	54.0	11.4
Birch	43.4	5.5	6.6	23.0	8.3
Other hardwoods	43.1	4.9	8.1	20.4	9.7
Total	3,475.0	483.8	1,003.6	1,626.0	361.6
All species	3,486.5	483.8	1,004.8	1,636.3	361.6

[1/] International 1/4-inch rule.

Table 43.--Net volume of growing stock, sawtimber, and rough and rotten trees on commercial forest land by county, Iowa, 1974

County	Growing stock	Rough and rotten[1/]	Sawtimber
	Thousand cubic feet		Thousand board feet[2/]
NORTHEASTERN			
Allamakee	85,128	28,281	283,398
Benton	11,170	4,268	37,602
Black Hawk	6,589	3,263	21,055
Bremer	10,695	3,778	37,506
Buchanan	7,383	2,990	23,745
Butler	5,683	2,642	19,557
Cedar	11,046	4,237	36,787
Chickasaw	6,083	2,117	20,654
Clayton	67,421	23,129	230,933
Clinton	17,187	7,467	56,678
Delaware	13,548	4,616	45,508
Dubuque	27,861	9,932	91,541
Fayette	21,968	7,245	74,766
Floyd	4,799	1,906	16,091
Grundy	379	188	1,169
Howard	5,094	1,676	17,285
Jackson	42,770	15,737	141,002
Johnson	15,075	5,582	51,854
Jones	20,337	7,745	66,261
Linn	21,343	8,379	69,850
Mitchell	3,821	1,288	13,692
Scott	7,292	3,136	24,284
Tama	14,875	5,579	50,692
Winneshiek	32,460	10,715	108,284
Total	460,007	165,896	1,540,194
SOUTHEASTERN			
Appanoose	16,092	4,219	50,925
Boone	13,170	2,940	44,573
Clarke	12,793	3,651	37,171
Dallas	13,277	2,926	44,109
Davis	16,707	4,390	52,222
Decatur	16,664	4,814	50,691
Des Moines	18,156	4,301	59,100
Guthrie	17,990	4,013	59,823
Hamilton	4,344	1,050	14,578
Hardin	6,412	1,464	20,846
Henry	13,606	3,519	41,337
Iowa	14,799	3,146	50,811
Jasper	8,819	1,936	30,483
Jefferson	12,166	2,917	39,385
Keokuk	12,227	2,628	40,642
Lee	32,950	8,127	101,413
Louisa	19,984	4,052	70,708
Lucas	19,873	4,883	62,011
Madison	16,529	4,314	52,500
Mahaska	12,637	2,648	43,064
Marion	10,945	2,992	34,993
Marshall	6,739	1,326	23,790
Monroe	22,009	5,579	68,379
Muscatine	14,633	3,164	49,747
Polk	7,525	1,849	26,300
Poweshiek	5,346	1,197	18,060
Story	4,151	874	14,058
Van Buren	22,760	6,036	71,624
Wapello	16,327	3,789	53,133
Warren	15,597	3,828	51,645
Washington	13,760	3,040	45,317
Wayne	9,830	2,436	31,234
Webster	12,920	2,845	42,888
Total	461,737	110,893	1,497,560

(Table 43 continued on next page)

(Table 43 continued)

WESTERN

County	Growing stock	Rough and rotten[1]	Sawtimber
	Thousand cubic feet		Thousand board feet[2]
Adair	3,304	844	10,242
Adams	4,975	1,072	17,765
Audubon	541	165	1,601
Buena Vista	1,103	258	3,220
Calhoun	640	77	3,020
Carroll	634	81	2,770
Cass	1,636	393	6,039
Cerro Gordo	602	60	2,368
Cherokee	2,342	593	7,789
Clay	2,521	527	9,176
Crawford	2,445	601	7,381
Dickinson	111	66	211
Emmet	1,441	339	5,443
Franklin	2,320	403	9,224
Fremont	7,231	1,838	23,025
Greene	4,619	887	17,756
Hancock	211	86	542
Harrison	15,936	3,982	50,579
Humboldt	1,607	307	5,742
Ida	531	42	2,470
Kossuth	2,480	372	10,403
Lyon	1,118	224	4,017
Mills	7,331	1,773	24,308
Monona	12,006	3,170	37,022
Montgomery	3,007	620	10,970
O'Brien	911	168	3,776
Osceola	89	23	327
Page	4,438	1,005	14,591
Palo Alto	1,159	215	4,236
Plymouth	3,150	716	10,935
Pocahontas	436	105	1,035
Potawattamie	7,716	1,849	25,554
Ringgold	8,180	2,023	26,588
Sac	1,025	219	4,117
Shelby	1,231	254	4,806
Sioux	723	102	3,149
Taylor	5,718	1,381	19,164
Union	7,304	1,782	23,263
Winnebago	67	23	120
Woodbury	7,690	1,857	25,277
Worth	593	175	1,858
Wright	1,804	384	6,813
Total	132,926	31,061	448,692
State total	1,054,670	307,850	3,486,446

[1] Includes short-log trees.

[2] International 1/4-inch rule.

Table 44.--Black walnut volume on nonforest land by diameter class and class of timber, Iowa, 1974

Diameter class (Inches at breast height)	Timber class			
	Growing stock	Sawtimber	Short-log	Rough and rotten
	Thousand cubic feet	Thousand board feet[1/]		Thousand cubic feet
5.0- 6.9	219	--	--	159
7.0- 8.9	132	--	--	--
9.0-10.9	--	--	--	921
11.0-12.9	486	2,847	633	215
13.0-14.9	923	5,304	747	155
15.0-16.9	860	4,781	--	446
17.0-18.9	--	--	--	222
19.0-20.9	--	--	--	296
21.0-22.9	--	--	--	--
23.0-28.9	585	2,569	--	--
29.0-38.9	--	--	--	--
39.0+	--	--	--	--
All classes	3,205	15,501	1,380	2,414

[1/] International 1/4-inch rule.

Table 45.--Net annual growth of growing stock on commercial forest land by species and Forest Survey Unit, Iowa, 1973

(In thousand cubic feet)

Species	All units	North-eastern	South-eastern	Western
Softwoods:				
Eastern redcedar	237	34	113	90
Other softwoods	8	8	--	--
Total	245	42	113	90
Hardwoods:				
Select white oaks	6,634	1,857	3,904	873
Select red oaks	3,349	1,499	1,654	196
Other white oaks	53	7	46	--
Other red oaks	1,427	35	1,379	13
Hickory	3,477	741	2,419	317
Hard maple	1,407	1,270	137	--
Soft maple	6,232	2,212	3,785	235
Ash	2,171	888	918	365
Cottonwood	4,518	1,227	1,525	1,766
Aspen	955	911	44	--
Basswood	2,307	1,657	572	78
Elm	1,370	2,315	-809	-136
Black walnut	1,254	596	498	160
Black cherry	615	356	230	29
Hackberry	1,045	174	638	233
Willow	2,256	572	917	767
Birch	1,233	1,055	178	--
Other hardwoods	756	99	590	67
Total	41,059	17,471	18,625	4,963
All species	41,304	17,513	18,738	5,053

Table 46.--Net annual growth of sawtimber on commercial forest land by species and Forest Survey Unit, Iowa, 1973

(In thousand board feet)[1/]

Species	All units	North-eastern	South-eastern	Western
Softwoods:				
Eastern redcedar	-224	-391	154	13
Other softwoods	--	--	--	--
Total	-224	-391	154	13
Hardwoods:				
Select white oaks	18,212	6,217	10,239	1,756
Select red oaks	9,195	4,438	4,404	353
Other white oaks	117	37	80	--
Other red oaks	1,421	-222	1,643	--
Hickory	2,449	712	1,496	241
Hard maple	3,387	3,054	333	--
Soft maple	16,681	5,112	10,763	806
Ash	2,364	1,253	798	313
Cottonwood	18,246	4,805	6,638	6,803
Aspen	1,152	989	163	--
Basswood	5,376	4,416	648	312
Elm	-8,285	-385	-5,359	-2,541
Black walnut	1,603	910	498	195
Black cherry	684	513	171	--
Hackberry	1,050	171	753	126
Willow	3,064	763	1,741	560
Birch	2,102	1,618	484	--
Other hardwoods	1,181	262	797	122
Total	79,999	34,663	36,290	9,046
All species	79,775	34,272	36,444	9,059

[1/] International 1/4-inch rule.

Table 47.--Net annual growth of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Iowa, 1973

Ownership class	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			Thousand board feet[1/]		
Public	6,672	--	6,672	12,716	--	12,716
Forest Industry	470	--	470	848	--	848
Farmer	24,365	180	24,185	46,151	-224	46,375
Miscellaneous Private	9,797	65	9,732	20,060	--	20,060
All owners	41,304	245	41,059	79,775	-224	79,999

[1/] International 1/4-inch rule.

Table 48.--Timber removals from growing stock by species, Iowa, 1973

(In thousand cubic feet)

Species	Total	Removals for products 1/	Other removals
Softwoods:			
Eastern redcedar	80	6	74
Other softwoods	28	25	3
Total	108	31	77
Hardwoods:			
Select white oaks	12,313	1,643	10,670
Select red oaks	7,293	1,875	5,418
Other white oaks	89	11	78
Other red oaks	2,710	642	2,068
Hickory	4,083	591	3,492
Hard maple	1,070	418	652
Soft maple	4,229	1,258	2,971
Ash	2,599	1,477	1,122
Cottonwood	3,857	2,076	1,781
Aspen	663	139	524
Basswood	1,707	648	1,059
Elm	5,711	2,959	2,752
Black walnut	637	559	78
Black cherry	456	21	435
Hackberry	596	115	481
Willow	956	131	825
Birch	535	152	383
Other hardwoods	688	142	546
Total	50,192	14,857	35,335
All species	50,300	14,888	35,412

1/ Includes logging residues.

Table 49.--Timber removals from sawtimber by species, Iowa, 1973

(In thousand board feet)[1/]

Species	Total	Removals for products[2/]	Other removals
Softwoods:			
Eastern redcedar	128	15	113
Other softwoods	132	123	9
Total	260	138	122
Hardwoods:			
Select white oaks	38,564	6,487	32,077
Select red oaks	26,820	7,598	19,222
Other white oaks	228	38	190
Other red oaks	8,012	2,143	5,869
Hickory	8,064	2,512	5,552
Hard maple	3,969	1,963	2,006
Soft maple	15,042	6,714	8,328
Ash	7,046	4,456	2,590
Cottonwood	19,554	11,969	7,585
Aspen	1,502	631	871
Basswood	6,605	3,476	3,129
Elm	17,015	11,376	5,639
Black walnut	2,490	2,490	--
Black cherry	789	113	676
Hackberry	1,702	635	1,067
Willow	2,338	568	1,770
Birch	1,736	750	986
Other hardwoods	1,518	469	1,049
Total	162,994	64,388	98,606
All species	163,254	64,526	98,728

1/ International 1/4-inch rule.

2/ Includes logging residues.

Table 50.--Net annual growth and removals of growing stock on commercial forest land by ownership class and softwoods and hardwoods, Iowa, 1973

(In thousand cubic feet)

Ownership class	Net annual growth			Annual removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
Public	6,672	--	6,672	57	--	57
Forest industry	470	--	470	368	--	368
Farmer and miscellaneous private	34,162	245	33,917	49,875	108	49,767
All owners	41,304	245	41,059	50,300	108	50,192

Table 51.--Net annual growth and removals of sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Iowa, 1973

(In thousand board feet)[1/]

Ownership class	Net annual growth			Annual removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
Public	12,716	--	12,716	248	--	248
Forest industry	848	--	848	1,642	--	1,642
Farmer and miscellaneous private	66,211	-224	66,435	161,364	260	161,104
All owners	79,775	-224	79,999	163,254	260	162,994

[1/] International 1/4-inch rule.

Table 52.--Net annual growth and removals of growing stock on commercial forest land by species, Iowa, 1973

(In thousand cubic feet)

Species	Net annual growth	Annual timber removals
Softwoods:		
Eastern redcedar	237	80
Other softwoods	8	28
Total	245	108
Hardwoods:		
Select white oaks	6,634	12,313
Select red oaks	3,349	7,293
Other white oaks	53	89
Other red oaks	1,427	2,710
Hickory	3,477	4,083
Hard maple	1,407	1,070
Soft maple	6,232	4,229
Ash	2,171	2,599
Cottonwood	4,518	3,857
Aspen	955	663
Basswood	2,307	1,707
Elm	1,370	5,711
Black walnut	1,254	637
Black cherry	615	456
Hackberry	1,045	596
Willow	2,256	956
Birch	1,233	535
Other hardwoods	756	688
Total	41,059	50,192
All species	41,304	50,300

Table 53.--Net annual growth and removals of sawtimber on commercial forest land by species, Iowa, 1973

(In thousand board feet)[1/]

Species	Net annual growth	Annual timber removals
Softwoods:		
Eastern redcedar	-224	128
Other softwoods	--	132
Total	-224	260
Hardwoods:		
Select white oaks	18,212	38,564
Select red oaks	9,195	26,820
Other white oaks	117	228
Other red oaks	1,421	8,012
Hickory	2,449	8,064
Hard maple	3,387	3,969
Soft maple	16,681	15,042
Ash	2,364	7,046
Cottonwood	18,246	19,554
Aspen	1,152	1,502
Basswood	5,376	6,605
Elm	-8,285	17,015
Black walnut	1,603	2,490
Black cherry	684	789
Hackberry	1,050	1,702
Willow	3,064	2,338
Birch	2,102	1,736
Other hardwoods	1,181	1,518
Total	79,999	162,994
All species	79,775	163,254

[1/] International 1/4-inch rule.

Table 54.--Timber removals from growing stock on commercial forest land by items and softwoods and hardwoods, Iowa, 1973

(In thousand cubic feet)

Item	All species	Softwoods	Hardwoods
Roundwood products:			
Saw logs	7,162	17	7,145
Veneer logs and bolts	865	--	865
Pulpwood	1,609	--	1,609
Cooperage logs and bolts	93	--	93
Piling	--	--	--
Poles	--	--	--
Mine timbers	8	--	8
Posts	126	--	126
Other	222	--	222
Fuelwood	3,106	12	3,094
All products	13,191	29	13,162
Logging residues	1,697	2	1,695
Other removals	35,412	77	35,335
Total removals	50,300	108	50,192

Table 55.--Timber removals from sawtimber on commercial forest land by items and softwoods and hardwoods, Iowa, 1973

(In thousand board feet)[1/]

Item	All species	Softwoods	Hardwoods
Roundwood products:			
Saw logs	41,176	105	41,071
Veneer logs and bolts	3,921	--	3,921
Pulpwood	7,017	--	7,017
Cooperage logs and bolts	562	--	562
Piling	--	--	--
Poles	--	--	--
Mine timbers	10	--	10
Posts	373	--	373
Other	1,210	--	1,210
Fuelwood	7,387	30	7,357
All products	61,656	135	61,521
Logging residues	2,870	3	2,867
Other removals	98,728	122	98,606
Total removals	163,254	260	162,994

[1/] International 1/4-inch rule.

Table 56.--Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Iowa, 1973.

Ownership class	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	-Thousand cubic feet-			-Thousand board feet[1/]-		
Public	270	--	270	1,222	--	1,222
Forest industry	80	--	80	299	--	299
Farmer	4,603	50	4,553	17,558	99	17,459
Miscellaneous private	1,954	--	1,954	6,596	--	6,596
All owners	6,907	50	6,857	25,675	99	25,576

[1/] International 1/4-inch rule.

Table 57.--Annual mortality of growing stock and sawtimber on commercial forest land by cause and softwoods and hardwoods, Iowa, 1973

Cause	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	- - - -Thousand cubic feet- - - -			- - - -Thousand board feet[1/] - - - -		
Insects	--	--	--	--	--	--
Disease	6,027	--	6,027	22,480	--	22,480
Fire	--	--	--	--	--	--
Animals	--	--	--	--	--	--
Weather	396	--	396	1,816	--	1,816
Suppression	147	--	147	--	--	--
Unknown and other	337	50	287	1,379	99	1,280
Logging	--	--	--	--	--	--
Timber stand improvement	--	--	--	--	--	--
Land clearing	--	--	--	--	--	--
Conversion	--	--	--	--	--	--
All causes	6,907	50	6,857	25,675	99	25,576

[1/] International 1/4-inch rule.

Table 58.--Annual mortality of growing stock on commercial forest land by species and Forest Survey Unit, Iowa, 1973

(In thousand cubic feet)

Species	All units	North-eastern	South-eastern	Western
Softwoods:				
Eastern redcedar	50	50	--	--
Other softwoods	--	--	--	--
Total	50	50	--	--
Hardwoods:				
Select white oaks	225	119	106	--
Select red oaks	801	505	296	--
Other white oaks	--	--	--	--
Other red oaks	729	586	143	--
Hickory	133	133	--	--
Hard maple	--	--	--	--
Soft maple	--	--	--	--
Ash	121	121	--	--
Cottonwood	--	--	--	--
Aspen	45	45	--	--
Basswood	79	79	--	--
Elm	4,261	1,605	1,912	744
Black walnut	37	37	--	--
Black cherry	--	--	--	--
Hackberry	--	--	--	--
Willow	241	241	--	--
Birch	73	73	--	--
Other	112	112	--	--
Total	6,857	3,656	2,457	744
All species	6,907	3,706	2,457	744

Table 59.--Annual mortality of sawtimber on commercial forest land by species and Forest Survey Unit, Iowa, 1973.

(In thousand board feet)[1/]

Species	All units	North-eastern	South-eastern	Western
Softwoods:				
Eastern redcedar	99	99	--	--
Other softwoods	--	--	--	--
Total	99	99	--	--
Hardwoods:				
Select white oaks	290	--	290	--
Select red oaks	3,242	2,410	832	--
Other white oaks	--	--	--	--
Other red oaks	3,179	2,152	1,027	--
Hickory	575	575	--	--
Hard maple	--	--	--	--
Soft maple	--	--	--	--
Ash	548	548	--	--
Cottonwood	--	--	--	--
Aspen	--	--	--	--
Basswood	391	391	--	--
Elm	16,017	5,966	6,497	3,554
Black walnut	--	--	--	--
Black cherry	--	--	--	--
Hackberry	--	--	--	--
Willow	986	986	--	--
Birch	348	348	--	--
Other hardwoods	--	--	--	--
Total	25,576	13,376	8,646	3,554
All species	25,675	13,475	8,646	3,554

[1/] International 1/4-inch rule.

Table 60.--Timber products output from roundwood by species and Forest Survey Unit, Iowa, 1972

(In thousand cubic feet)

Species	All units	North-eastern	South-eastern	Western
Softwoods:				
White and red pine	37	16	--	21
Eastern redcedar	19	--	--	19
Total	56	16	--	40
Hardwoods:				
Select white oaks	2,121	1,296	787	38
Select red oaks	2,398	1,802	587	9
Other white oaks	13	5	8	--
Other red oaks	728	458	269	1
Hickory	721	435	285	1
Hard maple	348	343	--	5
Soft maple	1,573	363	969	241
Ash	3,720	395	121	3,204
Cottonwood	1,884	355	820	709
Aspen	198	100	93	5
Basswood	674	625	40	9
Elm	6,532	2,318	683	3,531
Black walnut	1,155	703	328	124
Black cherry	23	21	2	
Hackberry	132	52	73	7
Willow	252	220	27	5
Birch	192	59	133	--
Other hardwoods	197	107	66	24
Total	22,861	9,657	5,291	7,913
All species	22,917	9,673	5,291	7,953

Table 61.--Output of timber products by source of material and softwoods and hardwoods, Iowa, 1972

Products and species group	Standard unit	Total		Output from roundwood				Output from plant byproducts	
				Growing stock		Nongrowing stock			
		Number of units	Thousand cu. ft.	Number of units	Thousand cu. ft.	Number of units	Thousand cu. ft.	Number of units	Thousand cu. ft.
aw logs and olts:	Thousand bd. ft.[1/]								
Softwood		105	17	105	17	--	--	--	--
Hardwood		53,389	8,987	43,021	7,145	10,368	1,842	--	--
Total		53,494	9,004	43,126	7,162	10,368	1,842	--	--
eneer logs nd bolts:	Thousand bd. ft.[1/]								
Softwood		--	--	--	--	--	--	--	--
Hardwood		5,187	1,157	3,877	865	1,310	292	--	--
Total		5,187	1,157	3,877	865	1,310	292	--	--
ooperage logs:	Thousand bd. ft.[1/]								
Softwood		--	--	--	--	--	--	--	--
Hardwood		626	102	570	93	56	9	--	--
Total		626	102	570	93	56	9	--	--
ulpwood:	Standard cords[2/]								
Softwood		11,482	907	--	--	--	--	11,482[3/]	907[3/]
Hardwood		43,136	3,408	20,367	1,609	10,532	832	12,237	967
Total		54,618	4,315	20,367	1,609	10,532	832	23,719	1,874
oles:	Thousand pieces								
Softwood		--	--	--	--	--	--	--	--
Hardwood		--	--	--	--	--	--	--	--
Total		--	--	--	--	--	--	--	--
ine timbers:	Thousand cu. ft.								
Softwood		--	--	--	--	--	--	--	--
Hardwood		10	10	8	8	2	2	--	--
Total		10	10	8	8	2	2	--	--
osts:	Thousand pieces								
Softwood		1	4/	1	4/	--	--	--	--
Hardwood		325	185	223	126	102	59	--	--
Total		326	185	224	126	102	59	--	--
harcoal wood:	Standard cords								
Softwood		--	--	--	--	--	--	--	--
Hardwood		--	--	--	--	--	--	--	--
Total		--	--	--	--	--	--	--	--
ther:[5/]	Thousand cu. ft.								
Softwood		3	3	--	--	--	--	3	3
Hardwood		1,377	1,377	222	222	--	--	1,155	1,155
Total		1,380	1,380	222	222	--	--	1,158	1,158
elwood:	Standard cords								
Softwood		600	39	185	12	415	27	--	--
Hardwood		156,299	10,160	47,597	3,094	102,502	6,663	6,200	403
Total		156,899	10,199	47,782	3,106	102,917	6,690	6,200	403
l products:	Thousand cu. ft.								
Softwood		966	966	29	29	27	27	11,485	910
Hardwood		25,386	25,386	13,162	13,162	9,699	9,699	19,592	2,525
tal		26,352	26,352	13,191	13,191	9,726	9,726	31,077	3,435

1/ International 1/4-inch rule.

2/ Cords are on a roughwood, 128 cubic foot basis.

3/ All softwood plant byproducts are from secondary wood-using plants (for example, millwork and furniture plants).

4/ Less than 500 cubic feet.

5/ Includes farm timbers, mulch, livestock bedding, poultry litter, etc.

Table 62.--Output of roundwood products by source, and softwoods and hardwoods, Iowa, 1972

(In thousand cubic feet)

Products and species group	All sources	Growing-stock trees 1/			Rough and rotten trees 1/	Salvable dead trees 1/	Other sources 2/
		Total	Sawtimber	Poletimber			
Industrial products:							
Sawlogs and bolts:							
Softwood	17	17	17	--	--	--	--
Hardwood	8,987	7,145	7,037	108	1,651	81	110
Total	9,004	7,162	7,054	108	1,651	81	110
Veneer logs and bolts:							
Softwood	--	--	--	--	--	--	--
Hardwood	1,157	865	865	--	216	--	76
Total	1,157	865	865	--	216	--	76
Pulpwood:							
Softwood	--	--	--	--	--	--	--
Hardwood	2,441	1,609	1,512	97	397	15	420
Total	2,441	1,609	1,512	97	397	15	420
All industrial products:							
Softwood	17	17	17	--	--	--	--
Hardwood	12,585	9,619	9,414	205	2,264	96	606
Total	12,602	9,636	9,431	205	2,264	96	606
Misc. industrial products:							
Cooperage:							
Softwood	--	--	--	--	--	--	--
Hardwood	102	93	93	--	9	--	--
Total	102	93	93	--	9	--	--
Piling:							
Softwood	--	--	--	--	--	--	--
Hardwood	--	--	--	--	--	--	--
Total	--	--	--	--	--	--	--
Poles:							
Softwood	--	--	--	--	--	--	--
Hardwood	--	--	--	--	--	--	--
Total	--	--	--	--	--	--	--
Mine timbers:							
Softwood	--	--	--	--	--	--	--
Hardwood	10	8	1	7	1	--	1
Total	10	8	1	7	1	--	1
Posts							
Softwood	--	--	--	--	--	--	--
Hardwood	185	126	89	37	26	2	31
Total	185	126	89	37	26	2	31
Other:							
Softwood	--	--	--	--	--	--	--
Hardwood	222	222	202	20	--	--	--
Total	222	222	202	20	--	--	--
All misc. industrial products:							
Softwood	--	--	--	--	--	--	--
Hardwood	519	449	385	64	36	2	32
Total	519	449	385	64	36	2	32
All industrial products:							
Softwood	17	17	17	--	--	--	--
Hardwood	12,585	9,619	9,414	205	2,264	96	606
Total	12,602	9,636	9,431	205	2,264	96	606
Fuelwood:							
Softwood	39	12	6	6	5	6	16
Hardwood	9,757	3,094	1,472	1,622	1,367	1,559	3,737
Total	9,796	3,106	1,478	1,628	1,372	1,565	3,753
All products:							
Softwood	56	29	23	6	5	6	16
Hardwood	22,861	13,162	11,271	1,891	3,667	1,657	4,375
Total	22,917	13,191	11,294	1,897	3,672	1,663	4,391

1/ On commercial forest land.

2/ Includes trees less than 5.0 inches in diameter, tree tops and limbs from commercial forest areas or material from noncommercial forest land or nonforest lands such as fence rows on suburban areas.

Table 63.--Roundwood production by species, Forest Survey Unit and product, Iowa, 1972

Species	Saw logs	Veneer logs[1]	Pulpwood	Other products
	Thousand board feet		Standard cords[2]	Thousand cubic feet
NORTHEASTERN				
Softwoods	97	--	--	--
White oak	4,558	10	2,000	329
Red oak	8,750	707	3,600	253
Hickory	464	--	3,600	71
Hard maple	1,538	216	400	--
Soft maple	1,495	108	222	82
Ash	1,104	111	200	164
Cottonwood	2,130	35	222	--
Aspen	158	--	778	13
Basswood	2,017	252	89	240
Elm	5,528	233	222	1,369
Black walnut	1,354	1,650	--	48
Black cherry	100	3	45	--
Hackberry	291	--	89	--
Willow	347	--	--	164
Birch	216	--	222	6
Other hardwoods	91	33	--	85
All species	30,238	3,358	11,689	2,824
SOUTHEASTERN				
Softwoods	--	--	--	--
White oak	1,786	8	5,094	72
Red oak	2,296	190	5,094	1
Hickory	315	569	849	33
Hard maple	--	--	--	--
Soft maple	4,529	6	2,335	65
Ash	330	--	--	65
Cottonwood	4,050	50	2,335	--
Aspen	--	--	1,167	--
Basswood	136	--	234	--
Elm	1,426	204	234	391
Black walnut	840	663	--	--
Black cherry	13	--	--	--
Hackberry	236	--	467	--
Willow	61	--	234	--
Birch	256	--	1,167	--
Other hardwoods	2	8	--	64
All species	16,276	1,698	19,210	691

(Table 63 continued on next page)

(Table 63 continued) WESTERN

Species	Products			
	Saw logs	Veneer logs	Pulpwood	Other products
	Thousand board feet[1]		Standard cords[2]	Thousand cubic feet
Softwoods	8	--	--	39
White oak	164	--	--	8
Red oak	33	22	--	--
Hickory	4	--	--	--
Hard maple	30	--	--	--
Soft maple	450	7	--	167
Ash	215	--	--	3,168
Cottonwood	4,594	--	--	--
Aspen	30	--	--	--
Basswood	52	--	--	--
Elm	854	2	--	3,394
Black walnut	475	100	--	--
Black cherry	--	--	--	--
Hackberry	41	--	--	--
Willow	30	--	--	--
Birch	--	--	--	--
Other hardwoods	--	--	--	24
All species	6,980	131	--	6,800
	ALL UNITS			
Softwoods	105	--	--	39
White oak	6,508	18	7,094	409
Red oak	11,079	919	8,694	254
Hickory	783	569	4,449	104
Hard maple	1,568	216	400	--
Soft maple	6,474	121	2,557	314
Ash	1,649	111	200	3,397
Cottonwood	10,774	85	2,557	--
Aspen	188	--	1,945	13
Basswood	2,205	252	323	240
Elm	7,808	439	456	5,154
Black walnut	2,669	2,413	--	48
Black cherry	113	3	45	--
Hackberry	568	--	556	--
Willow	438	--	234	164
Birch	472	--	1,389	6
Other hardwoods	93	41	--	173
All species	53,494	5,187	30,899	10,315

[1] International 1/4-inch rule.
[2] Roughwood basis, 128 cubic feet per standard cord.

Table 64.--Roundwood production in Iowa, 1953 and 1972

(In thousand cubic feet)

Product	All species		Softwoods		Hardwoods	
	1953	1972	1953	1972	1953	1972
Saw logs	9,600	9,004	240	17	9,360	8,987
Veneer logs	700	1,157	--	--	700	1,157
Cooperage logs	500	102	--	--	500	102
Pulpwood	200	2,441	--	--	200	2,441
Posts	1,200	185	--	--	1,200	185
Fuelwood	24,000	9,796	--	39	24,000	9,757
Other products[1/]	400	232	--	--	400	232
All products	36,600	22,917	240	56	36,360	22,861

[1/] Includes mine and farm timbers.

Table 65.--Forest products harvested by ownership class, product, and Forest Survey Unit, Iowa, 1972

Ownership class	Saw logs	Veneer logs	Cooperage logs	Pulpwood	Posts	Mine timbers	Fuelwood	Misc.
	Thousand board feet[1/]			Cords[2/]	Thousand pieces	Thousand cubic feet	Cords[2/]	Thousand cubic feet
NORTHEASTERN								
Federal:								
Softwoods	--	--	--	--	--	--	--	--
Hardwoods	--	--	--	--	--	--	270	--
State:								
Softwoods	--	--	--	--	--	--	--	--
Hardwoods	84	12	--	9	--	--	--	--
Private:								
Industrial:								
Softwoods	--	--	--	--	--	--	--	--
Hardwoods	616	66	--	--	--	--	--	--
Farm and other:								
Softwoods	97	--	--	--	--	--	--	--
Hardwoods	29,441	3,280	355	11,680	160	2	37,800	199
All owners:								
Softwoods	97	--	--	--	--	--	--	--
Hardwoods	30,141	3,358	355	11,689	160	2	38,070	199
SOUTHEASTERN								
Federal:								
Softwoods	--	--	--	--	--	--	--	--
Hardwoods	--	--	--	--	--	--	--	--
State:								
Softwoods	--	--	--	--	1	--	--	--
Hardwoods	132	34	--	95	--	--	20	--
Private:								
Industrial:								
Softwoods	--	--	--	--	--	--	--	--
Hardwoods	427	693	28	1,039	--	--	--	--
Farm and other:								
Softwoods	--	--	--	--	--	--	--	--
Hardwoods	15,717	971	203	18,076	118	8	8,489	23
All owners:								
Softwoods	--	--	--	--	1	--	--	--
Hardwoods	16,276	1,698	231	19,210	118	8	8,509	23
WESTERN								
Federal:								
Softwoods	--	--	--	--	--	--	--	--
Hardwoods	--	--	--	--	--	--	--	--
State:								
Softwoods	--	--	--	--	--	--	--	--
Hardwoods	--	--	--	--	--	--	--	--
Private:								
Industrial:								
Softwoods	--	--	--	--	--	--	--	--
Hardwoods	116	28	--	--	--	--	--	--
Farm and other:								
Softwoods	8	--	--	--	--	--	600	--
Hardwoods	6,856	103	40	--	47	--	103,520	--
All owners:								
Softwoods	8	--	--	--	--	--	600	--
Hardwoods	6,972	131	40	--	47	--	103,520	--
ALL UNITS								
Federal:								
Softwoods	--	--	--	--	--	--	--	--
Hardwoods	--	--	--	--	--	--	270	--
State:								
Softwoods	--	--	--	--	1	--	--	--
Hardwoods	216	46	--	104	--	--	20	--
Private:								
Industrial:								
Softwoods	--	--	--	--	--	--	--	--
Hardwoods	1,159	787	28	1,039	--	--	--	--
Farm and other:								
Softwoods	105	--	--	--	--	--	600	--
Hardwoods	52,014	4,354	598	29,756	325	10	149,809	222
All owners:								
Softwoods	105	--	--	--	1	--	600	--
Hardwoods	53,389	5,187	626	30,899	325	10	150,099	222

[1/] International 1/4-inch rule.
[2/] Standard cords, roughwood basis.

Table 66.--Saw log production by species and state of destination, Iowa, 1972

(In thousand board feet)[1/]

Species	Iowa	Missouri	Minnesota	Kansas	Other states	Total
NORTHEASTERN						
Softwoods:						
White pine	95	0	0	0	0	95
Red pine	2	0	0	0	0	2
Redcedar	0	0	0	0	0	0
Total	97	0	0	0	0	97
Hardwoods:						
White oak	4,246	0	311	0	1	4,558
Red oak	8,297	0	312	0	141	8,750
Hickory	464	0	0	0	0	464
Hard maple	1,520	0	14	0	4	1,538
Soft maple	1,345	150	0	0	0	1,495
Ash	1,090	0	14	0	0	1,104
Cottonwood	2,118	0	0	0	12	2,130
Aspen	144	0	14	0	0	158
Basswood	1,947	0	70	0	0	2,017
Elm	5,528	0	0	0	0	5,528
Black walnut	966	331	14	42	1	1,354
Black cherry	100	0	0	0	0	100
Hackberry	291	0	0	0	0	291
Willow	347	0	0	0	0	347
Birch	202	0	14	0	0	216
Other species	91	0	0	0	0	91
Total	28,696	481	763	42	159	30,141
All species	28,793	481	763	42	159	30,238
SOUTHEASTERN						
Softwoods:						
White pine	0	0	0	0	0	0
Red pine	0	0	0	0	0	0
Redcedar	0	0	0	0	0	0
Total	0	0	0	0	0	0
Hardwoods:						
White oak	1,762	24	0	0	0	1,786
Red oak	2,284	12	0	0	0	2,296
Hickory	315	0	0	0	0	315
Hard maple	0	0	0	0	0	0
Soft maple	4,260	269	0	0	0	4,529
Ash	330	0	0	0	0	330
Cottonwood	4,009	24	0	0	17	4,050
Aspen	0	0	0	0	0	0
Basswood	136	0	0	0	0	136
Elm	1,426	0	0	0	0	1,426
Black walnut	156	199	0	485	0	840
Black cherry	13	0	0	0	0	13
Hackberry	235	1	0	0	0	236
Willow	61	0	0	0	0	61
Birch	256	0	0	0	0	256
Other species	2	0	0	0	0	2
Total	15,245	529	0	485	17	16,276
All species	15,245	529	0	485	17	16,276

(Table 66 continued on next page)

(Table 66 continued)

Species	Iowa	Missouri	Minnesota	Kansas	Other states	Total
			WESTERN			
Softwoods:						
White pine	8	0	0	0	0	8
Red pine	0	0	0	0	0	0
Redcedar	0	0	0	0	0	0
Total	8	0	0	0	0	8
Hardwoods:						
White oak	163	1	0	0	0	164
Red oak	33	0	0	0	0	33
Hickory	4	0	0	0	0	4
Hard maple	30	0	0	0	0	30
Soft maple	245	161	0	0	44	450
Ash	206	7	0	0	2	215
Cottonwood	4,578	0	0	0	16	4,594
Aspen	30	0	0	0	0	30
Basswood	44	5	0	0	3	52
Elm	832	0	0	0	22	854
Black walnut	285	173	0	17	0	475
Black cherry	0	0	0	0	0	0
Hackberry	30	11	0	0	0	41
Willow	30	0	0	0	0	30
Birch	0	0	0	0	0	0
Other species	0	0	0	0	0	0
Total	6,510	358	0	17	87	6,972
All species	6,518	358	0	17	87	6,980
			ALL UNITS			
Softwoods:						
White pine	103	0	0	0	0	103
Red pine	2	0	0	0	0	2
Redcedar	0	0	0	0	0	0
Total	105	0	0	0	0	105
Hardwoods:						
White oak	6,171	25	311	0	1	6,508
Red oak	10,614	12	312	0	141	11,079
Hickory	783	0	0	0	0	783
Hard maple	1,550	0	14	0	4	1,568
Soft maple	5,850	580	0	0	44	6,474
Ash	1,626	7	14	0	2	1,649
Cottonwood	10,705	24	0	0	45	10,774
Aspen	174	0	14	0	0	188
Basswood	2,127	5	70	0	3	2,205
Elm	7,786	0	0	0	22	7,808
Black walnut	1,407	703	14	544	1	2,669
Black cherry	113	0	0	0	0	113
Hackberry	556	12	0	0	0	568
Willow	438	0	0	0	0	438
Birch	458	0	14	0	0	472
Other species	93	0	0	0	0	93
Total	50,451	1,368	763	544	263	53,389
All species	50,556	1,368	763	544	263	53,494

1/ International 1/4-inch rule.

Table 67.--Saw log production and receipts by species, Iowa, 1969 and 1972

(In thousand board feet)[1/]

Species	Production			Receipts		
	1969	1972	Change	1969	1972	Change
Softwoods	223	105	(-)118	223	105	(-)118
White oak	4,785	6,508	1,723	4,905	6,758	1,853
Red oak	7,329	11,079	3,750	7,771	11,317	3,546
Hickory	365	783	418	441	862	421
Hard maple	1,490	1,568	78	1,670	1,588	(-)82
Soft maple	9,434	6,474	(-)2,960	8,140	6,391	(-)1749
Ash	1,213	1,649	436	1,270	1,697	427
Cottonwood	6,931	10,774	3,843	6,296	11,436	5,140
Aspen	222	188	(-)34	192	178	(-)14
Basswood	1,565	2,205	640	1,672	2,180	508
Elm	7,976	7,808	(-)168	8,054	7,840	(-)214
Black walnut	4,356	2,669	(-)1,687	2,756	7,509	4,753
Black cherry	117	113	(-)4	170	117	(-)53
Birch	323	472	149	272	496	224
Other hardwoods	587	1,099	512	572	1,147	575
All species	46,916	53,494	6,578	44,404	59,621	15,217

[1/] International 1/4-inch rule.

Table 68.--Saw log receipts by species and state of origin, Iowa, 1972

(In thousand board feet)[1/]

Species	All states	NORTHEASTERN Iowa	Missouri	Illinois	Wisconsin	Arkansas	Kansas	Nebraska	Minnesota	South Dakota
Softwoods:										
White pine	93	93	0	0	0	0	0	0	0	0
Red pine	2	2	0	0	0	0	0	0	0	0
Total	95	95	0	0	0	0	0	0	0	0
Hardwoods:										
White oak	4,848	4,692	0	60	72	0	0	0	24	0
Red oak	9,572	9,160	0	80	164	0	0	0	168	0
Hickory	550	536	0	5	6	0	0	0	3	0
Hard maple	1,548	1,510	0	10	16	0	0	0	12	0
Soft maple	2,254	2,247	0	0	3	0	0	0	4	0
Ash	1,235	1,214	0	7	9	0	0	0	5	0
Cottonwood	2,272	2,265	0	0	2	0	0	0	5	0
Aspen	138	134	0	0	1	0	0	0	3	0
Basswood	1,995	1,963	0	10	14	0	0	0	8	0
Elm	6,166	6,129	0	12	17	0	0	0	8	0
Black walnut	2,055	1,025	0	235	671	0	0	0	124	0
Black cherry	104	100	0	2	2	0	0	0	0	0
Hackberry	272	272	0	0	0	0	0	0	0	0
Willow	339	339	0	0	0	0	0	0	0	0
Birch	218	218	0	0	0	0	0	0	0	0
Other species	114	91	0	4	19	0	0	0	0	0
Total	33,680	31,895	0	425	996	0	0	0	364	0
All species	33,775	31,990	0	425	996	0	0	0	364	0
					SOUTHEASTERN					
Hardwoods:										
White oak	1,753	1,354	180	219	0	0	0	0	0	0
Red oak	1,732	1,441	173	118	0	0	0	0	0	0
Hickory	308	243	40	25	0	0	0	0	0	0
Hard maple	40	40	0	0	0	0	0	0	0	0
Soft maple	4,115	3,581	374	160	0	0	0	0	0	0
Ash	394	352	29	13	0	0	0	0	0	0
Cottonwood	4,662	4,326	229	107	0	0	0	0	0	0
Aspen	40	40	0	0	0	0	0	0	0	0
Basswood	168	147	10	11	0	0	0	0	0	0
Elm	1,364	1,347	15	2	0	0	0	0	0	0
Black walnut	97	80	15	2	0	0	0	0	0	0
Black cherry	13	13	0	0	0	0	0	0	0	0
Hackberry	301	284	15	2	0	0	0	0	0	0
Willow	99	99	0	0	0	0	0	0	0	0
Birch	278	240	35	3	0	0	0	0	0	0
Other species	22	2	10	10	0	0	0	0	0	0
Total	15,386	13,589	1,125	672	0	0	0	0	0	0
All species	15,386	13,589	1,125	672	0	0	0	0	0	0

(Table 68 continued on next page)

(Table 68 continued)

Species	All states	Iowa	Missouri	Illinois	Wisconsin	Arkansas	Kansas	Nebraska	Minnesota	South Dakota
					WESTERN					
oftwoods:										
White pine	10	10	0	0	0	0	0	0	0	0
Red pine	0	0	0	0	0	0	0	0	0	0
Total	10	10	0	0	0	0	0	0	0	0
ardwoods:										
White oak	157	125	0	0	0	0	0	32	0	0
Red oak	13	13	0	0	0	0	0	0	0	0
Hickory	4	4	0	0	0	0	0	0	0	0
Hard maple	0	0	0	0	0	0	0	0	0	0
Soft maple	22	22	0	0	0	0	0	0	0	0
Ash	68	60	0	0	0	0	0	8	0	0
Cottonwood	4,502	4,114	0	0	0	0	0	194	0	194
Aspen	0	0	0	0	0	0	0	0	0	0
Basswood	17	17	0	0	0	0	0	0	0	0
Elm	310	310	0	0	0	0	0	0	0	0
Black walnut	5,357	302	3,183	0	0	756	705	411	0	0
Black cherry	0	0	0	0	0	0	0	0	0	0
Hackberry	0	0	0	0	0	0	0	0	0	0
Willow	0	0	0	0	0	0	0	0	0	0
Birch	0	0	0	0	0	0	0	0	0	0
Other species	0	0	0	0	0	0	0	0	0	0
Total	10,450	4,967	3,183	0	0	756	705	645	0	194
ll species	10,460	4,977	3,183	0	0	756	705	645	0	194
					ALL UNITS					
oftwoods:										
White pine	103	103	0	0	0	0	0	0	0	0
Red pine	2	2	0	0	0	0	0	0	0	0
Total	105	105	0	0	0	0	0	0	0	0
ardwoods:										
White oak	6,758	6,171	180	279	72	0	0	32	24	0
Red oak	11,317	10,614	173	198	164	0	0	0	168	0
Hickory	862	783	40	30	6	0	0	0	3	0
Hard maple	1,588	1,550	0	10	16	0	0	0	12	
Soft maple	6,391	5,850	374	160	3	0	0	0	4	0
Ash	1,697	1,626	29	20	9	0	0	8	5	0
Cottonwood	11,436	10,705	229	107	2	0	0	194	5	194
Aspen	178	174	0	0	1	0	0	0	3	0
Basswood	2,180	2,127	10	21	14	0	0	0	8	0
Elm	7,840	7,786	15	14	17	0	0	0	8	0
Black walnut	7,509	1,407	3,198	237	671	756	705	411	124	0
Black cherry	117	113	0	2	2	0	0	0	0	0
Hackberry	573	556	15	2	0	0	0	0	0	0
Willow	438	438	0	0	0	0	0	0	0	0
Birch	496	458	35	3	0	0	0	0	0	0
Other species	136	93	10	14	19	0	0	0	0	
Total	59,516	50,451	4,308	1,097	996	756	705	645	364	194
ll species	59,621	50,556	4,308	1,097	996	756	705	645	364	194

1/ International 1/4-inch rule.

Table 69.--Veneer log and bolt production by species and state or country of destination, Iowa, 1972

(In thousand board feet)[1/]

Species	Total	Destination						
		Iowa	Wisconsin	Indiana	Illinois	Ohio	Missouri	Other State
Softwoods:								
White pine	0	0	0	0	0	0	0	0
Red pine	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Hardwoods:								
White oak	18	6	5	0	2	5	0	0
Red oak	919	168	743	0	8	0	0	0
Hickory	569	569	0	0	0	0	0	0
Hard maple	216	0	161	33	22	0	0	0
Soft maple	121	0	95	0	0	0	0	26
Ash	111	79	32	0	0	0	0	0
Cottonwood	85	0	0	0	0	0	0	85
Aspen	0	0	0	0	0	0	0	0
Basswood	252	0	252	0	0	0	0	0
Elm	439	204	235	0	0	0	0	0
Black walnut	2,413	149	0	492	230	220	147	[2/]1,175
Black cherry	3	0	3	0	0	0	0	0
Hackberry	0	0	0	0	0	0	0	0
Willow	0	0	0	0	0	0	0	0
Birch	0	0	0	0	0	0	0	0
Other species	41	0	0	17	0	0	24	0
Total	5,187	1,175	1,526	542	262	225	171	1,286
All species	5,187	1,175	1,526	542	262	225	171	1,286

[1/] International 1/4-inch rule.

[2/] Exported to other countries.

Table 70.--Veneer log production for selected years, Iowa, 1960-1972

(In thousand board feet)[1/]

Species	1960	1963	1966	1968	1970	1972
Red oak	919	551	867	1,385	930	919
Hickory	--	--	7	32	361	569
Hard maple	584	337	245	454	292	216
Soft maple	822	223	320	182	97	121
Cottonwood	1,040	71	849	411	1,121	85
Elm	1,070	34	(2/)	641	483	439
Black walnut	3/3,138	3/4,339	3/3,138	3/3,429	3/785	4/2,413
Other hardwoods	1,376	990	1,484	1,148	525	425
All species	8,949	6,545	6,910	7,682	4,594	5,187

1/ International 1/4-inch rule.

2/ Included with "other hardwoods".

3/ Does not include exports overseas.

4/ Includes exports overseas.

Table 71.--Pulpwood production by species groups, Iowa, 1956-1972

(In standard cords, roughwood basis)

Year	Total all sources	From roundwood				From residue	
		Total	Softwoods	Soft hardwoods	Hard hardwoods	Softwoods	Hardwoods
1956	19,000	19,000	--	15,000	4,000	--	--
1957	14,505	14,505	--	10,487	4,018	--	--
1958	15,079	15,079	--	9,443	5,636	--	--
1959	21,129	21,129	--	11,803	9,326	--	--
1960	23,496	23,496	100	15,376	8,020	--	--
1961	22,461	22,461	--	12,411	10,050	--	--
1962	(1/)	28,490	--	14,403	14,087	--	(1/)
1963	(1/)	19,572	--	10,372	9,200	--	(1/)
1964	(1/)	32,998	80	15,320	17,598	--	(1/)
1965	31,079	24,678	--	12,596	12,082	--	6,401
1966	36,324	27,149	--	13,959	13,190	--	9,175
1967	35,343	27,040	--	11,675	15,365	--	8,303
1968	37,862	24,877	--	12,035	12,842	2,833	10,152
1969	31,580	16,851	40	8,031	8,780	1,501	13,228
1970	57,681	36,101	80	16,321	19,700	10,227	11,353
1971	52,537	37,859	40	14,843	22,976	7,908	6,770
1972	54,618	30,899	--	10,062	20,837	11,482	12,237

1/ Not available.

Table 72.--Production and disposition of softwood and hardwood plant byproducts and plant residue by type of byproduct, disposal, Forest Survey Unit, and county, Iowa 1972

(In thousand cubic feet)

NORTHEASTERN

County and type of use	Plant byproducts and plant residue							
	Total		Coarse1/		Fine2/		Bark	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Allamakee								
Fiber products	0	153.3	0	153.3	0	0	0	0
Miscellaneous3/	0	39.2	0	0	0	39.2	0	1.9
Not used4/	0	50.2	0	0	0	50.2	0	97.1
Total	0	242.7	0	153.3	0	89.4	0	99.0
Benton								
Domestic fuel	0	0.7	0	0.7	0	0	0	0.5
Miscellaneous3/	0	57.3	0	0	0	57.3	0	0
Not used4/	0	98.6	0	98.2	0	0.4	0	63.4
Total	0	156.6	0	98.9	0	57.7	0	63.9
Black hawk								
Domestic fuel	0	19.2	0	19.2	0	0	0	12.4
Miscellaneous3/	0	11.2	0	0	0	11.2	0	0
Total	0	30.4	0	19.2	0	11.2	0	12.4
Butler								
Domestic fuel	0	0	0	0	0	0	0	12.4
Miscellaneous3/	0	22.4	0	0	0	22.4	0	0
Not used4/	0	53.6	0	48.0	0	5.6	0	18.6
Total	0	76.0	0	48.0	0	28.0	0	31.0
Cedar								
Domestic fuel	0	57.6	0	57.6	0	0	0	37.2
Miscellaneous3/	0	33.6	0	0	0	33.6	0	0
Not used4/	0	136.8	0	86.4	0	50.4	0	55.8
Total	0	228.0	0	144.0	0	84.0	0	93.0
Clayton								
Fiber products	0	332.1	0	332.1	0	0	0	58.9
Domestic fuel	0	47.0	0	47.0	0	0	0	30.4
Miscellaneous3/	0	157.9	0	20.2	0	137.7	0	44.3
Not used4/	0	95.2	0	0	0	95.2	0	124.3
Total	0	632.2	0	399.3	0	232.9	0	257.9
Delaware								
Fiber products	0	95.0	0	95.0	0	0	0	0
Not used4/	0	55.4	0	0	0	55.4	0	61.4
Total	0	150.4	0	95.0	0	55.4	0	61.4
Dubuque								
Fiber products	0	57.6	0	57.6	0	0	0	364.6
Miscellaneous3/	0	16.8	0	0	0	16.8	0	0
Not used4/	0	158.2	0	77.9	0	80.3	0	95.6
Total	0	232.6	0	135.5	0	97.1	0	460.2
Jackson								
Fiber products	0	89.2	0	89.2	0	0	0	57.6
Domestic fuel	0	24.0	0	24.0	0	0	0	15.5
Miscellaneous3/	0	57.8	0	0	0	57.8	0	0
Not used4/	0	53.7	0	28.7	0	25.0	0	18.5
Total	0	224.7	0	141.9	0	82.8	0	91.6
Johnson								
Domestic fuel	0	22.0	0	22.0	0	0	0	14.2
Miscellaneous3/	0	16.0	0	0	0	16.0	0	0
Not used4/	0	5.5	0	5.5	0	0	0	3.5
Total	0	43.5	0	27.5	0	16.0	0	17.7
Jones								
Fiber products	0	22.5	0	22.5	0	0	0	14.1
Miscellaneous3/	0	17.8	0	0	0	17.8	0	0
Not used4/	0	151.1	0	90.0	0	61.1	0	62.3
Total	0	191.4	0	112.5	0	78.9	0	76.4
Linn								
Domestic fuel	0	16.8	0	16.8	0	0	0	10.9
Miscellaneous3/	0	12.8	0	1.9	0	10.9	0	1.2
Not used4/	0	54.0	0	34.1	0	19.9	0	22.1
Total	0	83.6	0	52.8	0	30.8	0	34.2
Mitchell								
Miscellaneous3/	2.1	2.1	0	0	2.1	2.1	0	0
Not used4/	3.6	3.6	3.6	3.6	0	0	2.3	2.3
Total	5.7	5.7	3.6	3.6	2.1	2.1	2.3	2.3

(Table 72 continued on next page)

(Table 72 continued)

SOUTHEASTERN (continued)

County and type of use	Plant byproducts and plant residue							
	Total		Coarse1/		Fine2/		Bark	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Monroe								
Domestic fuel	0	7.6	0	0.6	0	7.0	0	7.8
Not used4/	0	11.4	0	11.4	0	0	0	0
Total	0	19.0	0	12.0	0	7.0	0	7.8
Van Buren								
Domestic fuel	0	5.6	0	5.6	0	0	0	3.5
Miscellaneous3/	0	22.1	0	0	0	22.1	0	0
Not used4/	0	117.6	0	86.1	0	31.5	0	55.7
Total	0	145.3	0	91.7	0	53.6	0	59.2
Wapello								
Domestic fuel	0	21.0	0	21.0	0	0	0	13.6
Miscellaneous3/	0	49.0	0	0	0	49.0	0	0
Not used4/	0	63.0	0	63.0	0	0	0	40.7
Total	0	133.0	0	84.0	0	49.0	0	54.3
Warren								
Not used4/	0	7.6	0	4.8	0	2.8	0	3.1
Total	0	7.6	0	4.8	0	2.8	0	3.1
Washington								
Domestic fuel	0	19.8	0	19.8	0	0	0	12.8
Miscellaneous3/	0	15.4	0	0	0	15.4	0	0
Not used4/	0	40.8	0	28.2	0	12.6	0	18.2
Total	0	76.0	0	48.0	0	28.0	0	31.0
All counties, Southeast								
Fib products	0	194.4	0	194.4	0	0	0	0
Domestic fuel	0	102.4	0	95.4	0	7.0	0	69.0
Miscellaneous3/	0	256.8	0	0	0	256.8	0	53.5
Not used4/	0	616.2	0	448.9	0	167.3	0	782.2
Total	0	1,169.8	0	738.7	0	431.1	0	904.7
WESTERN								
Clay								
Industrial fuel	0	68.4	0	0	0	68.4	0	55.4
Miscellaneous3/	0	62.1	0	50.0	0	12.1	0	0
Total	0	130.5	0	50.0	0	80.5	0	55.4
Franklin								
Miscellaneous3/	0.3	2.5	0	0	0.3	2.5	0	0
Not used4/	0.5	4.3	0.5	4.3	0	0	0.3	2.8
Total	.8	6.8	.5	4.3	.3	2.5	0.3	2.8
Greene								
Domestic fuel	0	2.8	0	0	0	2.8	0	0
Not used4/	0	4.8	0	4.8	0	0	0	3.1
Total	0	7.6	0	4.8	0	2.8	0	3.1
Hancock								
Domestic fuel	0	3.1	0	3.1	0	0	0	0
Miscellaneous3/	0	1.8	0	0	0	1.8	0	0
Not used4/	0	0	0	0	0	0	0	2.0
Total	0	4.9	0	3.1	0	1.8	0	2.0
Humboldt								
Domestic fuel	0	1.9	0	1.9	0	0	0	0
Miscellaneous3/	0	1.1	0	0	0	1.1	0	0
Not used4/	0	0	0	0	0	0	0	1.2
Total	0	3.0	0	1.9	0	1.1	0	1.2
Lyon								
Industrial fuel	0	0.5	0	0.5	0	0	0	0
Not used4/	0	0.3	0	0	0	0.3	0	0.3
Total	0	.8	0	0.5	0	0.3	0	0.3
Page								
Domestic fuel	0	0.6	0	0.6	0	0	0	0
Miscellaneous3/	0	0.4	0	0	0	0.4	0	0
Not used4/	0	9.0	0	5.7	0	3.3	0	4.1
Total	0	10.0	0	6.3	0	3.7	0	4.1
Pottawattamie								
Miscellaneous3/	0	199.2	0	199.2	0	0	0	0
Not used4/	0	431.7	0	199.2	0	232.5	0	257.4
Total	0	630.9	0	398.4	0	232.5	0	257.4

(Table 72 continued on next page)

(Table 72 continued)

NORTHEASTERN (continued)

County and type of use	Plant byproducts and plant residue							
	Total		Coarse1/		Fine2/		Bark	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Scott								
Fiber products	0	45.6	0	45.6	0	0	0	0
Miscellaneous3/	0	30.4	0	2.4	0	28.0	0	0
Not used4/	0	0	0	0	0	0	0	31.0
Total	0	76.0	0	48.0	0	28.0	0	31.0
Tama								
Domestic fuel	0.1	35.0	0.1	35.0	0	0	0.1	22.6
Miscellaneous3/	0.4	97.6	0	0	0.4	97.6	0	0
Not used4/	0.6	132.3	0.6	132.3	0	0	0.4	85.6
Total	1.1	264.9	0.7	167.3	0.4	97.6	0.5	108.2
All counties, Northeast								
Fiber producs	0	795.3	0	795.3	0	0	0	495.2
Domestic fuel	0.1	222.3	0.1	222.3	0	0	0.1	156.1
Miscellaneous3/	2.5	572.9	0	24.5	2.5	548.4	0	47.4
Not used4/	4.2	1,048.2	4.2	604.7	0	443.5	2.7	741.5
Total	6.8	2,638.7	4.3	1,646.8	2.5	991.9	2.8	1,440.2
SOUTHEASTERN								
Appanoose								
Fiber products	0	67.2	0	67.2	0	0	0	0
Miscellaneous3/	0	31.4	0	0	0	31.4	0	0
Not used4/	0	8.9	0	0.7	0	8.2	0	43.8
Total	0	107.5	0	67.9	0	39.6	0	43.8
Dallas								
Miscellaneous3/	0	17.9	0	0	0	17.9	0	0
Not used4/	0	30.7	0	30.7	0	0	0	19.8
Total	0	48.6	0	30.7	0	17.9	0	19.8
Davis								
Domestic fuel	0	0.4	0	0.4	0	0	0	0.3
Miscellaneous3/	0	4.2	0	0	0	4.2	0	0
Not used4/	0	6.8	0	6.8	0	0	0	4.4
Total	0	11.4	0	7.2	0	4.2	0	4.7
Hamilton								
Miscellaneous3/	0	1.8	0	0	0	1.8	0	0
Not used4/	0	7.8	0	6.0	0	1.8	0	3.9
Total	0	9.6	0	6.0	0	3.6	0	3.9
Hardin								
Domestic fuel	0	48.0	0	48.0	0	0	0	31.0
Miscellaneous3/	0	42.0	0	0	0	42.0	0	0
Not used4/	0	62.0	0	48.0	0	14.0	0	31.0
Total	0	152.0	0	96.0	0	56.0	0	62.0
Iowa								
Miscellaneous3/	0	16.4	0	0	0	16.4	0	0
Not used4/	0	28.1	0	28.1	0	0	0	18.1
Total	0	44.5	0	28.1	0	16.4	0	18.1
Lee								
Fiber products	0	127.2	0	127.2	0	0	0	0
Miscellaneous3/	0	40.1	0	0	0	40.1	0	51.0
Not used4/	0	115.3	0	51.3	0	64.0	0	491.9
Total	0	282.6	0	178.5	0	104.1	0	542.9
Louisa								
Miscellaneous3/	0	1.0	0	0	0	1.0	0	0
Not used4/	0	77.7	0	49.7	0	28.0	0	32.1
Total	0	78.7	0	49.7	0	29.0	0	32.1
Marion								
Miscellaneous3/	0	6.3	0	0	0	6.3	0	0
Not used4/	0	16.5	0	14.4	0	2.1	0	9.3
Total	0	22.8	0	14.4	0	8.4	0	9.3
Marshall								
Miscellaneous3/	0	9.2	0	0	0	9.2	0	2.5
Not used4/	0	22.0	0	19.7	0	2.3	0	10.2
Total	0	31.2	0	19.7	0	11.5	0	12.7

(Table 72 continued on next page)

(Table 72 continued)

WESTERN (continued)

County and type of use	Plant byproducts and plant residue							
	Total		Coarse1/		Fine2/		Bark	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Sioux								
Domestic fuel	0	0.5	0	0.5	0	0	0	0
Miscellaneous3/	0	0.8	0	0.5	0	0.3	0	0
Not used4/	0	13.9	0	8.6	0	5.3	0	6.2
Total	0	15.2	0	9.6	0	5.6	0	6.2
Union								
Miscellaneous3/	0	3.6	0	0	0	3.6	0	0
Not used4/	0	6.2	0	6.2	0	0	0	4.0
Total	0	9.8	0	6.2	0	3.6	0	4.0
Woodbury								
Miscellaneous3/	0	51.6	0	15.5	0	36.1	0	20.0
Not used4/	0	46.5	0	46.5	0	0	0	20.0
Total	0	98.1	0	62.0	0	36.1	0	40.0
Wright								
Domestic fuel	0	0.5	0	0.5	0	0	0	0
Miscellaneous3/	0	2.5	0	0	0	2.5	0	0.9
Not used4/	0	3.8	0	3.8	0	0	0	1.8
Total	0	6.8	0	4.3	0	2.5	0	2.7
All counties, Western								
Industrial fuel	0	68.9	0	0.5	0	68.4	0	55.4
Domestic fuel	0	9.4	0	6.6	0	2.8	0	0
Miscellaneous3/	0.3	325.6	0	265.2	0.3	60.4	0	20.9
Not used4/	0.5	520.5	0.5	279.1	0	241.4	0.3	302.9
Total	0.8	924.4	0.5	551.4	0.3	373.0	0.3	379.2
			ALL UNITS					
All counties								
Fiber products	0	989.7	0	989.7	0	0	0	495.2
Industrial fuel	0	68.9	0	0.5	0	68.4	0	55.4
Domestic fuel	0.1	334.1	0.1	324.3	0	9.8	0.1	225.1
Miscellaneous3/	2.8	1,155.3	0	289.7	2.8	865.6	0	121.8
Not used4/	4.7	2,184.9	4.7	1,332.7	0	852.2	3.0	1,826.6
Total	7.6	4,732.9	4.8	2,936.9	2.8	1,796.0	3.1	2,724.1

1/ Suitable for chipping such as slabs, edgings, veneer cores, etc.

2/ Not suitable for chipping such as sawdust, veneer clippings, etc.

3/ Livestock bedding, mulch, small dimension, and specialty items.

4/ Plant residue.

Table 73.--Volume of primary plant byproducts and plant residue by source industry, kind of material, and type of use, Iowa, 1972

(In thousand cubic feet)

Source industry and kind of material	Plant byproducts by type of use							
	Fiber[1]	Fuel[2]			Other[3]		Plant residue[4]	
		Industrial	Domestic					
	Hardwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Lumber:								
Coarse[5]	987.2	0.5	0.1	324.3	--	239.7	4.7	1,305.0
Fine[6]	--	0.1	--	9.8	2.8	847.3	--	809.5
Bark	129.4	--	0.1	225.1	--	79.0	3.0	1,411.6
Total	1,116.6	0.6	0.2	559.2	2.8	1,166.0	7.7	3,526.1
All other:								
Coarse[5]	2.5	--	--	--	--	50.0	--	27.7
Fine[6]	--	68.3	--	--	--	18.3	--	42.7
Bark	365.8	55.4	--	--	--	42.8	--	415.0
Total	368.3	123.7	--	--	--	111.1	--	485.4
All industries:								
Coarse[5]	989.7	0.5	0.1	324.3	--	289.7	4.7	1,332.7
Fine[6]	--	68.4	--	9.8	2.8	865.6	--	852.2
Bark	495.2	55.4	0.1	225.1	--	121.8	3.0	1,826.6
Total	1,484.9	124.3	0.2	559.2	2.8	1,277.1	7.7	4,011.5

[1] For manufacture of pulp, hardboard, or roofing felt.

[2] Includes fuel given away.

[3] Includes uses such as livestock bedding, mulch, small dimension, and specialty items.

[4] Includes residue burned as waste.

[5] Plant byproduct or residue suitable for chipping.

[6] Plant byproduct or residue not suitable for chipping.

Table 74.--Primary wood-using plants operating in 1972 by Forest Survey Unit, Iowa

(In number of plants)

Kind of mill[1]	All units	Northeastern	Southeastern	Western
Sawmills:				
Large[2]	21	13	6	2
Medium[3]	27	12	12	3
Small[4]	12	1	4	7
Subtotal	60	26	22	12
Veneer mills	2	1	--	1
Cooperage mills	1	1	--	--
Pulpmills	2	1	1	--
Subtotal	5	3	1	1
Total all mills	65	29	23	13

[1] Excludes idle mills.

[2] Annual output of more than 1 million board feet.

[3] Annual output of from 0.101 to 1.000 million board feet.

[4] Annual output of less than 0.101 million board feet.

Table 75.--Removals[1], net annual growth, and inventory of growing stock on commercial forest land, Iowa, 1974, and low removals option projections[2] to 2004.

(In million cubic feet)

Year	All species		
	Removals	Growth	Inventory
1974	50.3	41.3	1,054.7
1984	45.7	40.1	984.1
1994	41.8	39.3	948.6
2004	38.4	37.2	931.7

[1] Timber removals includes volume "lost" due to land clearing, flooding, thinning, or changes in land use, in addition to timber cut and used.

[2] Based on the following assumptions: (a) that the overall removals rate will be lower than that for the high removals option; (b) that annual removals rates will differ for each timber product but that timber removals will decrease at an average annual rate of 0.789 percent or 397 thousand cubic feet; (c) that the total area of commercial forest land will decline at an annual rate of 0.475 percent; (d) that radial growth will decline over time in relation to the increase of basal area per acre of trees; (e) that the intensity of forest management practiced will continue at the rate indicated by recent trends; (f) that the volume of "other" removals will drop during the period as more of these trees are utilized.

Table 76.--Removals[1], net annual growth, and inventory of growing stock on commercial forest land, Iowa, 1974, and high removals option projections[2] to 200

(In million cubic feet)

Year	All species		
	Removals	Growth	Inventory
1974	50.3	41.3	1,054.7
1984	49.3	39.7	961.4
1994	45.7	37.3	874.1
2004	44.3	32.7	773.9

[1] Timber removals includes volume "lost" due to land clearing, flooding, thinning, or changes in land use, in addition to timber cut and used.

[2] Based on the following assumptions: (a) that the overall removals rate will be higher than that for the low removals option; (b) that annual removals rates will differ for each timber product but that timber removals will decrease at an average annual rate of 0.398 percent or 200 thousand cubic feet; (c) that the total area of commercial forest land will decline at an annual rate of 0.475 percent; (d) that radial growth will decline over time in relation to the increase of basal area per acre of trees; (e) that the intensity of forest management practiced will continue at the rate indicated by recent trends; (f) that the volume of "other" removals will drop during the period as more of these trees are utilized.

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Forest Service
U.S. Department of Agriculture
1974

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PALO ALTO
HANCOCK
CERRO GORDO
FLOYD
CHICKASAW
FAYETTE
CLAYTON
PLYMOUTH
CHEROKEE
BUENA VISTA
POCAHONTAS
HUMBOLDT
WRIGHT
FRANKLIN
BUTLER
BREMER
WEBSTER
BLACK HAWK
BUCHANAN
DELAWARE
DUBUQUE
WOODBURY
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HAMILTON
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MONONA
CRAWFORD
CARROLL
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AUDUBON
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JASPER
POWESHIEK
IOWA
JOHNSON
SCOTT
MUSCATINE
POTTAWATTAMIE
CASS
ADAIR
MADISON
WARREN
MARION
MAHASKA
KEOKUK
WASHINGTON
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MILLS
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ADAMS
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MONROE
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JEFFERSON
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WAYNE
APPANOOSE
DAVIS
VAN BUREN
LEE

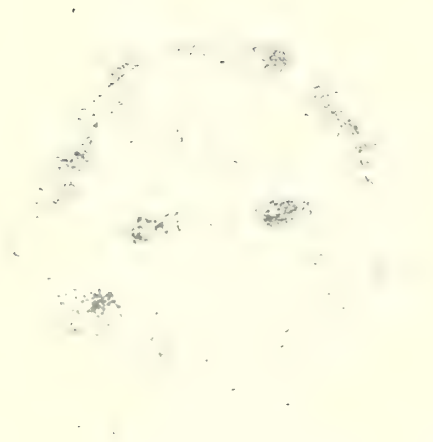
Scale 1:1,000,000

PINE
OAK-HICKORY
ELM-ASH-COTTONWOOD
PRODUCTIVE RESERVE

Spencer, John S., Jr., and Pamela J. Jakes.
1980. Iowa's forest resources, 1974. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-52, 90 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, MN.

The second inventory of Iowa's forest resources shows big declines in commercial forest area and in growing-stock and sawtimber volumes between 1954 and 1974. Presented are text and statistics on forest area and timber volume, growth, mortality, ownership, stocking, future timber supply, timber use, forest management opportunities, and nontimber resources.

KEY WORDS: timber volume, growth, utilization, forest areas.



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Forest Service—U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108
Manuscript approved for publication April 15, 1980

1980

FOREWORD

Resources Evaluation (formerly called Forest Survey) is a continuing endeavor as mandated by the Forest and Rangeland Renewable Resources Planning Act of 1974, which was preceded by the McSweeney-McNary Forest Research Act of 1928. Its objective is to periodically inventory the Nation's forest land to determine its extent, condition, and volume of timber, growth, and depletions. This kind of up-to-date information is essential to frame intelligent forest policies and programs. USDA Forest Service regional experiment stations are responsible for conducting these inventories and publishing summary reports for individual States. The North Central Forest Experiment Station is responsible for Resources Evaluation work done in Michigan, Wisconsin, Minnesota, North Dakota, eastern South Dakota, Nebraska, Iowa, Illinois, Indiana, Missouri, and Kansas.

Fieldwork for the 1977 Minnesota Forest Survey was begun in July 1974 and was completed in July 1978. Reports on the three previous surveys of Minnesota's timber resource are dated 1936, 1953, and 1962.

Similar Resource Bulletins reporting statistical highlights and detailed tables on the timber resource of the four Survey Units in Minnesota (see cover) are available.

More accurate survey information was obtained during the 1977 survey than otherwise would have been feasible because of intensified field sampling. This was made possible by extra funding and manpower provided the North Central Station by the State Legislature through the Minnesota Department of Natural Resources. The Department also assisted in a canvass of primary wood-using plants in the State, which was used to help estimate the quantity of timber products harvested in Minnesota.

Aerial photos used in the Minnesota Forest Inventory were furnished by the Boise Cascade Company, Chippewa National Forest, Lake County Land Commissioner's Office, Minnesota Department of Natural Resources, Superior National Forest, USDA Agricultural Stabilization and Conservation Service, and USDI Bureau of Indian Affairs.

The following North Central Forest Experiment Station office personnel helped prepare the State tables and manuscript:

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Patrick Peine, Statistical assistant
Gerhard K. Raile, Associate mensurationist
Carol Weist, Computer programmer

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MINNESOTA FOREST STATISTICS, 1977

Pamela J. Jakes
Associate Resource Analyst

HIGHLIGHTS

Area

- Commercial forest area declined from 15.4 million acres in 1962 to 13.7 million acres in 1977, an annual rate of change of -0.8 percent.
- Commercial forest area is concentrated in the Northern Pine (5.7 million acres) and Aspen-Birch (5.5 million acres) Forest Survey Units.
- Farmers own the largest portion of Minnesota's commercial forest land base (3.4 million acres), followed by the State of Minnesota (2.7 million acres) and county and municipal agencies (2.3 million acres).
- Aspen is the most common forest type in Minnesota, occurring on 5.3 million acres of commercial forest land.
- The majority of the commercial forest land (6.9 million acres) is in poletimber stands. The remaining commercial forest area is fairly evenly divided among sawtimber, and seedling and sapling stands.
- The area of productive-reserved forest land increased from 470,100 acres in 1962 to 1.2 million acres in 1977, due largely to creation of Voyageur's National Park and expansion of wilderness portions of the Boundary Waters Canoe Area.
- Eleven percent of Minnesota's forest land is unproductive.

Volume

- In 1977 there were 12.9 billion cubic feet of timber in Minnesota—11.4 billion cubic feet in growing-stock trees, 1.4 billion cubic feet in rough and rotten trees, and 0.1 billion cubic feet in salvable dead trees.
- Growing-stock volume per acre on commercial forest land increased from 613 cubic feet in 1962 to 836 cubic feet in 1977, resulting in a 21 percent increase in growing-stock volume, from 9.4 to 11.4 billion cubic feet.
- Sawtimber volume increased 65 percent between surveys, from 14.9 billion board feet in 1962 to 24.6 billion board feet in 1977. This reflects the increasing maturity of Minnesota's forests.
- Growing-stock volume is concentrated in the Northern Pine (5.0 billion cubic feet) and Aspen-Birch (4.5 billion cubic feet) Forest Survey Units.
- Aspen accounts for 30 percent of the growing-stock volume (3.4 billion cubic feet) and 24 percent of the sawtimber volume (6.0 billion board feet).
- Farmers own 2.7 billion cubic feet of growing-stock volume, county and municipal agencies own 2.0 billion cubic feet, and the State owns 1.9 billion cubic feet.

Stand Conditions

- Net annual growth of growing stock for softwoods increased from 106.8 million cubic feet in 1961 to 119.8 million cubic feet in 1976, but net annual growth for hardwoods decreased from 257.4 million cubic feet to 229.1 million cubic feet resulting in an overall decrease in net annual growth between surveys.
- Net annual growth rate of growing stock is 3.0 percent of inventory. The growth rate for softwoods (3.4 percent) is higher than the growth rate for hardwoods (2.9 percent).
- Net annual growth per acre remained fairly constant between surveys—24 cubic feet in 1961 compared to 25 cubic feet in 1976.
- Mortality of growing-stock trees averaged 1.2 percent of inventory.
- Disease is the most common cause of mortality and accounts for 57 percent of 141.5 million cubic feet.
- Sixty-five percent of Minnesota's commercial forest land is capable of growing trees at least 51 feet high at age 50.
- More than two-thirds of Minnesota's sawtimber volume is in butt log grade 3 timber.
- Fifty-seven percent of the commercial forest area is in stands less than 51 years old.

Timber Use

- Timber removals from growing stock totaled 193.6 million cubic feet in 1976—135.0 million cubic feet for timber products, 53.5 million cubic feet for other removals, and 5.1 million cubic feet for logging residue.
- Growing-stock removals in 1976 are 33 percent higher than removals in 1962. The increase is entirely due to greater hardwood removals.
- Fifty-four percent of growing-stock removals came from farmer-owned and miscellaneous private-owned land.
- Timber products output in 1975 totaled 169.9 million cubic feet—63 percent as pulpwood, 17 percent as saw logs, and 14 percent as fuelwood.
- Primary plant residue in 1975 totaled 11.6 million cubic feet—7.1 million cubic feet from hardwoods and 4.5 million cubic feet from softwoods. An additional 5.6 million cubic feet of residue was bark.

PRINCIPAL TREE SPECIES GROUPS IN MINNESOTA[1]

Softwoods:

Eastern white pine .....*Pinus strobu*
Red pine .....*Pinus resinos*
Jack pine .....*Pinus banksian*
Black spruce .....*Picea marian*
White spruce .....*Picea glauc*
Balsam fir .....*Abies balsame*
Tamarack .....*Larix laricin*
Northern white-cedar .....*Thuja occidentali*
Other softwoods:
  Eastern redcedar .....*Juniperus virginian*
  Scotch pine .....*Pinus sylvestri*

Hardwoods:

White oaks:
  White oak ..... *Quercus alb*
  Bur oak ..... *Quercus macrocarp*
  Swamp white oak ..... *Quercus bicolo*
Select red oak:
  Northern red oak .....*Quercus rubr*
Other red oaks:
  Black oak .....*Quercus velutin*
  Northern pin oak .....*Quercus ellipsoidali*
Hickories:
  Shagbark hickory .....*Carya ovat*
  Bitternut hickory .....*Carya cordiformi*
Yellow birch .....*Betula alleghaniens*
Hard maples:
  Sugar maple .....*Acer saccharu*
  Black maple .....*Acer nigru*
Soft maples:
  Red maple .....*Acer rubru*
  Silver maple .....*Acer saccharinu*
Ashes:
  White ash .....*Fraxinus american*
  Black ash .....*Fraxinus nig*
  Green ash .....*Fraxinus pennsylvanic*
Balsam poplar .....*Populus balsamifer*
Paper birch .....*Betula papyrifer*

[1] *The common and scientific names are based o "Check List of Native and Naturalized Trees of th United States (including Alaska)," by Elbert L. Littl Jr. 1979. U.S. Department of Agriculture, Agricu ture Handbook 541, 375 p.*

Aspens:
Bigtooth aspen .....*Populus grandidentata*
Quaking aspen .....*Populus tremuloides*
Basswood .....*Tilia americana*
Elms:
American elm .....*Ulmus americana*
Slippery elm .....*Ulmus rubra*
Rock elm .....*Ulmus thomassii*
Select hardwoods:
Butternut .....*Juglans cinerea*
Black walnut .....*Juglans nigra*
Black cherry .....*Prunus serotina*
Other hardwoods:
Boxelder .....*Acer negundo*
River birch .....*Betula nigra*
Hackberry .....*Celtis occidentalis*
Eastern cottonwood .....*Populus deltoides*
Black willow .....*Salix nigra*
Kentucky coffeetree .....*Gymnocladus dioicus*

APPENDIX

Accuracy of Survey

Resources Evaluation information is based on a sampling procedure designed to provide reliable statistics at the State and Survey Unit levels. Consequently, the reported figures are estimates only. However, a measure of reliability of these figures is given by sampling errors. These sampling errors mean that the chances are two out of three that if a 100-percent inventory had been taken, using the same methods, the results would have been within the limits indicated.

For example, the estimated area of commercial forest land in Minnesota in 1977, 13,695.1 thousand acres, has a sampling error of ± 0.39 percent (± 53,900 acres). The commercial forest area from a 100-percent inventory, then, would be expected to fall between 13,749.0 and 13,641.2 thousand acres (13,695.1 ± 53.9), there being a one in three chance that this is not the case.

Sampling errors were calculated separately for National Forest land and other land because of the higher sampling intensity on this land. For example, the sampling error for growing-stock volume on land other than National Forest is ± 0.82 percent but for Chippewa National Forest land it is ± 7.47 percent.

The following tabulation shows the combined sampling errors for the 1977 Minnesota Forest Inventory:

Item	Minnesota totals	Sampling error *(percent)*
Growing stock:		
Volume	11,454.0 million cubic feet	1.04
Growth	348.9 million cubic feet	1.42
Removals	193.6 million cubic feet	5.33
Sawtimber:		
Volume	24,607.2 million board feet	1.85
Growth	1,111.5 million board feet	1.72
Removals	460.3 million boardfeet	4.36
Commercial forest land:	13,695.1 thousand acres	0.39

As survey data are broken down into sections smaller than State or Survey Unit totals, the sampling error increases. The smaller the breakdown, the larger the sampling error. For example, the sampling error for area of commercial forest land in a particular county is higher than that for total commercial forest area in the Survey Unit (table 70 shows the sampling errors for estimates smaller than State totals).

Survey Procedure

The major steps in the survey of Minnesota were as follows:

1. A total of 276,897 1-acre points were systematically distributed across aerial photos of the entire

State, except the Chippewa and Superior National Forests. These points were classified as forest land (72,700), unproductive forest land (4,483), nonforest land (197,674), or questionable (2,040), in order to make a preliminary estimate of forest area. Next, all of the forest points (72,700), 592 of the unproductive forest points, and all of the questionable points (2,040) were stereoclassified as to forest type, stand-size class, and density. Then 9,796 points classed as forest, 592 points classed as unproductive, 276 points classed as questionable, and 25,498 points classified as nonforest were examined on the ground to correct the preliminary area estimate for errors in classification and for actual changes in land use since the photos were taken. At each of the 8,547 commercial forest locations, variable-radius plots (basal area factor 37.5) were established at 10 points uniformly placed over the sample acre. Tree measurements made at these locations were the basis for estimates of timber volume, growth, mortality, number of trees, and other forest classifications.

2. Growth and mortality on all commercial forest land were estimated using the Forest Resources Evaluation Program (FREP)[2]. This is an individual tree-growth projection system that uses stand and tree characteristics such as tree diameter, crown ratio, and stand density to estimate tree volumes.

3. Data from the National Forests were incorporated in the Survey data. Area statistics for the Chippewa National Forest were prepared by the Forest Timber Management staff from compartment examination records. In 1975, the Forest conducted its own forest inventory using 10-point variable-radius plots established by Forest personnel under the direction of the North Central Forest Experiment Station. Data from these plots were used as input for FREP, which, with modifications in the Program, was used to update volumes to 1977. The updated Chippewa National Forest data were approved by the Forest and combined with Survey data from non-National Forest commercial forest land to estimate volume, growth, and mortality for the State.

Area statistics for the Superior National Forest were also prepared by the Forest Timber Management staff from compartment examination records. Volume data for Superior National Forest land were prepared by staff using permanent sample plots established by Forest personnel. Superior National Forest data, then, were added to data for the rest of the State computed from 10-point variable radius plot information.

4. Statistics on timber utilization during 1975 were obtained from mill surveys. The Minnesota Department of Natural Resources and the North Central Forest Experiment Station canvassed resident sawmills, veneer mills, and other primary wood-using plants. The North Central Forest Experiment Station canvassed resident pulpmills, as well as out-of-State sawmills, pulpmills, and veneer mills to determine their use of timber from Minnesota. Fuelwood and fencepost output was based on a sample of private landowners to determine their production of fuelwood and fenceposts, and on a canvass of industrial and public timber owners. Estimates of primary mill residue used for fuelwood were obtained from the canvass of Minnesota primary wood-using plants. Timber cut for products by ownership class was determined by a canvass of public and industrial timber owners. The portion of timber cut unaccounted for by the latter owners was grouped under "farmer and other owners".

5. A total of 1,028 felled trees were measured throughout the State during 1975-1976 to develop wood utilization factors for converting timber products output to timber removals for saw logs and pulpwood. Factors for veneer logs were obtained during the 1967-1968 Wisconsin utilization study. Factors for all other products were obtained during the 1960-1961 Minnesota utilization study.

6. Field data were sent to St. Paul and compiled.

Comparing Minnesota's Fourth Survey with the Third Survey

Data from new forest surveys are often compared with data from earlier ones to determine trends in forest areas and volumes. Changes in procedures and definitions between surveys make it necessary to adjust earlier survey data so they are comparable to data from the new survey.

The Unit boundaries in Minnesota changed between surveys so published 1962 commercial forest area was adjusted to take these changes into account. Then, a portion of the 1962 commercial forest area was withdrawn and added to unproductive forest (noncommercial) and to nonforest to allow for changes in the method of determining land uses. The

[2]*For more information on FREP, see: U.S. Department of Agriculture, Forest Service. 1979. A generalized forest growth projection system for the Lake States Region. U.S. Department of Agriculture Forest Service, General Technical Report NC-49, 96 p.*

esulting adjusted 1962 commercial area was then ised to adjust 1962 inventory, net growth, and mor- ality volumes.

A test was made to ensure that it was possible to ove from the adjusted 1962 volumes to the new 977 volumes by means of Timber Resource Analysis ystem (TRAS), which is a Forest Service computer rogram for updating, backdating and projecting imber volume, growth, mortality, and removals. In rder for the program to work, the 2 years to be econciled must have comparable commercial forest nd bases so that changes in volumes between sur- eys reflect actual changes in forest conditions or and use. To achieve this condition, it was necessary o make further adjustments in 1962 data so that nd transferred from commercial forest to produc- ve-reserved between the two surveys would not ap- ear in the 1962 land base. If this adjustment were ot made, removals between 1962 and 1977 would ppear artificially high to absorb the loss of timber rom this change in land status. This adjustment was ade for the test only; area and volumes removed for e test were added back into the 1962 reported data.

TRAS recalculated 1962 volumes using 1977 esti- ates of cubic foot volume per tree and 1977 board ot-cubic foot ratios. This volume adjustment was ecessary so that volume differences between surveys epresented actual change and not merely change in e volume equations used on each occasion.

When the final adjustments of the 1962 data were mpleted, the resulting 1962 volumes and area were istributed among the four Survey Units. A check as made to ensure that it was possible to move from e adjusted 1962 volumes to the new 1977 volumes each Unit. This was done using the average peri- ic difference between growth and removals for the vo surveys and applying this difference to the 1962 olume. The same procedure was repeated for each dividual species within each Unit to make sure ventory volumes reported for each species were nsistent with reported growth and removals lumes.

Removals estimates for 1962 and 1977 are for total movals, including timber cut in addition to "other" movals, and are trend level removals. "Other" re- ovals from transfer of commercial forest land to oductive-reserved are not included. Previously blished 1960 estimates are of timber cut only and not include "other" removals. TRAS generated an timate of 1962 "other" removals to provide the ad- sted 1962 total removals.

Metric Equivalents of Units Used in this Report

1 acre = 4,046.86 square meters or 0.405 hectare.
1,000 acres = 405 hectares.
1,000 board feet (International ¼-inch log rule) = 3.48 cubic meters.
Breast height = 1.4 meters above the ground.
1 cubic foot = 0.0283 cubic meter.
1 foot = 30.48 centimeters or 0.3048 meter.
1 inch = 25.4 millimeters, 2.54 centimeters, or 0.0254 meter.

Definition of Terms

Land-use classes

Gross area.—The entire area of land and water as determined by the Bureau of Census, 1970.

Land area.—The area of dry land and land temporarily or partially covered by water such as marshes, swamps, flood plains, streams, sloughs, and estuaries. Canals less than ⅛-mile wide and lakes, reservoirs, and ponds smaller than 40 acres are included as land area. These figures are from the Bureau of Census, 1970.

Forest land.—Land at least 16.7 percent stocked by trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Includes afforested areas. The minimum forest area classified was 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas were classed as forest if less than 120 feet wide.

Commercial forest land.—Forest land that is producing or is capable of producing crops of industrial wood and that is not withdrawn from timber utilization by statute or administrative regulation. This includes areas capable of producing in excess of 20 cubic feet per acre of annual growth. This includes both inaccessible and inoperable areas.

Noncommercial forest land.—(a) Unproductive—forest land incapable of yielding crops of industrial wood because of adverse site conditions, (b) productive-reserved—forest land withdrawn from commercial timber use through statute or administrative regulation, or exclusively used for Christmas tree production.

Nonforest land.—Land that has never supported forests, and land formerly forested where forest use is precluded by development for nonforest uses, such as cropland, improved pasture, residential areas, and city parks. Also includes improved roads and adjoining rights-of-way, powerline clearings, and certain areas of water classified by the Bureau of Census as land. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide and clearings in forested areas must be more than 1 acre in size to qualify as nonforest land.

Ownership classes

National forest.—Federal land that has been designated by executive order or statute as National Forests or purchase units and other land under the administration of the USDA Forest Service.

Other Federal.—Federal land other than National Forest.

State, county, and municipal.—Land owned by States, counties, or local public agencies, or land leased by them for more than 50 years.

Forest industry.—Land owned by companies or individuals operating primary wood-using plants.

Farmer-owned.—Land owned by operators of farms. A farm must include 10 or more acres from which the sale of agricultural products totals $50 or more annually, or if less than 10 acres, the yield must be at least $250 annually.

Farmer-owned, leased.—Land owned by operators of farms but leased to other parties.

Miscellaneous private-corporation.—Land owned by a private corporation not in the business of operating primary wood-using plants.

Miscellaneous private-individual.—Land owned by a private individual. Miscellaneous private-corporation, leased.—Land owned by private corporations but leased to other parties. Miscellaneous private-individual, leased.—Land owned by private individuals but leased to other parties.

Tree classes

All live trees.—Growing-stock, rough, and rotten trees 1 inch d.b.h. and larger.

Growing-stock trees.—All live trees of commercial species except rough and rotten trees.

Desirable trees.—Growing-stock trees having no serious quality defects that would limit present or prospective use, possessing relatively high vigor, and containing no pathogens that may kill or seriously deteriorate it before rotation age. These are trees that would be favored by forest managers in silvicultural operations.

Acceptable trees.—Trees meeting the standards for growing stock but not qualifying as desirable trees.

Sawtimber trees.—Growing-stock trees of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs, each 8 feet or longer. At least 33 percent of the gross volume of the tree must be sound wood. Softwoods must be at least 9 inches d.b.h. and hardwoods at least 11 inches d.b.h.

Poletimber trees.—Growing-stock trees of commercial species at least 5.0 inches d.b.h. but smaller than sawtimber size, and of good form and vigor.

Saplings.—Live trees of commercial species 1 to 5 inches d.b.h. and of good form and vigor.

Seedlings.—Live trees of commercial species less than 1 inch d.b.h. that are expected to survive according to regional standards (examples of seedlings not expected to survive are those that are diseased or heavily damaged by logging, browsing, or fire). Only softwood seedlings more than 6 inches tall and hardwood seedlings more than 1 foot tall are counted.

Rotten trees.—Live trees (any size) of commercial species that do not contain a merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of rot (that is, when more than 50 percent of the cull volume of the tree is rotten).

Rough trees.—Live trees that do not contain at least one merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of roughness and poor form. Includes all live noncommercial species.

Short-log (rough trees).—Sawtimber-sized trees of commercial species that contain at least one merchantable 8- to 11-foot saw log but not a 12-foot saw log.

Stocking

The degree of land utilization by trees as measured in terms of basal area and or the number of trees in a stand compared to the basal area and/or number of trees required to fully utilize the growth potential of the land.

A stocking percent of 100 indicates full utilization of the site and is equivalent to 80 square feet of basal

area per acre in trees 5 inches d.b.h. and larger. In a stand of trees less than 5 inches d.b.h., a stocking percent of 100 would indicate that the present number of trees is sufficient to produce 80 square feet of basal area per acre when the trees reach 5 inches d.b.h.

Stocking of all live trees, growing-stock trees, and desirable trees are recorded separately and stands are grouped into the following stocking classes.

Stocking classes

Overstocked stands.—Stands in which stocking of trees is 133 percent or more.

Fully-stocked stands.—Stands in which stocking of trees is from 100 to 133 percent.

Medium-stocked stands.—Stands in which stocking of trees is from 60 to 100 percent.

Poorly-stocked stands.—Stands in which stocking of trees is from 16.7 to 60 percent.

Nonstocked areas.—Commercial forest land on which stocking of trees is less than 16.7 percent.

Stand-size classes

Stand.—A growth of trees on a minimum of 1 acre of forest land that is stocked by trees of any size.

Sawtimber stands.—Stands at least 16.7 percent stocked with growing-stock trees, at least half of which are sawtimber or poletimber and sawtimber stocking at least equal to that of poletimber.

Poletimber stands.—Stands at least 16.7 percent stocked with growing-stock trees, at least half of which are sawtimber and/or poletimber trees and poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands.—Stands at least 16.7 percent stocked with growing-stock trees and with saplings and/or seedlings comprising more than half of this stocking.

Nonstocked areas.—Commercial forest land on which stocking of growing-stock trees is less than 16.7 perent.

Other classifications

Site index.—An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Site class.—A classification of forest land in terms of inherent capacity to grow crops of industrial wood expressed in cubic-foot growth per acre per year.

Stand-age.—Age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Basal area.—The area in square feet of the cross section at breast height of a single tree. When the basal area of all the trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Biomass

The above-ground volume of all live trees (including bark and foliage) reported in green tons. Biomass is made up of 5 components:

Growing-stock bole.—Biomass of a growing-stock tree from a 1-foot stump to a variable 4-inch top.

Growing-stock tops and limbs.—Biomass of a growing-stock tree from a 1-foot stump minus the growing-stock bole.

Cull bole.—Biomass of a cull tree from a 1-foot stump to a variable 4-inch top.

Cull tops and limbs.—Biomass of a cull tree from a 1-inch stump minus the cull bole.

1- to 5-inch trees.—Biomass of all live trees 1- to 5-inches in diameter at breast height.

Forest types

A classification of forest land based on the species forming a plurality of live-tree stocking. Major forest types in Minnesota are:

Jack pine.—Forests in which jack pine comprises a plurality of the stocking. (Common associates include eastern white pine, red pine, aspen, birch, and maple.)

Red pine.—Forests in which red pine comprises a plurality of the stocking. (Common associates include eastern white pine, jack pine, aspen, birch, and maple.)

White pine.—Forests in which eastern white pine comprises a plurality of the stocking. (Common associates include red pine, jack pine, aspen, birch, and maple.)

Balsam fir.—Forests in which balsam fir and white spruce comprise a plurality of stocking with balsam fir the most common. (Common associates

include white spruce, aspen, maple, birch, northern white-cedar, and tamarack.)

White spruce.—Forests in which white spruce and balsam fir comprise a plurality of the stocking with white spruce the most common. (Common associates include balsam fir, aspen, maple, birch, northern white-cedar, and tamarack.)

Black spruce.—Forests in which swamp conifers comprise a plurality of the stocking with black spruce the most common. (Common associates include tamarack and northern white-cedar.)

Northern white-cedar.—Forests in which swamp conifers comprise a plurality of the stocking with northern white-cedar the most common. (Common associates include tamarack and black spruce.)

Tamarack.—Forests in which swamp conifers comprise a plurality of the stocking with tamarack the most common. (Common associates include black spruce and northern white-cedar.)

Oak.—Forests in which northern red oak, white oak, or bur oak, singly or in combination, comprise a plurality of the stocking. (Common associates include elm, maple, and aspen.)

Elm-ash-cottonwood.—Forests in which lowland elm, ash, cottonwood, and red maple, singly or in combination, comprises a plurality of the stocking. (Common associates include basswood and balsam poplar.)

Maple-basswood.—Forests in which sugar maple, basswood, yellow birch, upland American elm, and red maple, singly or in combination, comprises a plurality of the stocking. (Common associates include white pine and elm.)

Aspen.—Forests in which quaking aspen or bigtooth aspen, singly or in combination, comprises a plurality of the stocking. (Common associates include balsam poplar, balsam fir, and paper birch.)

Paper birch.—Forests in which paper birch comprises a plurality of the stocking. (Common associates include maple, aspen, and balsam fir.)

Balsam poplar.—Forests in which balsam poplar comprises a plurality of the stocking. (Common associates include aspen, elm, and ash.)

Timber volume

Volume of growing stock.—The volume of sound wood in the bole of growing-stock trees 5 inches d.b.h. and over, from a 1-foot stump to a minimum 4 inch top diameter outside bark, or to the point whe the central stem breaks into limbs. Growing-sto volumes are shown in cubic feet. They can be co verted to cords by multiplying by 79 (79 cubic fe solid wood cord).

Volume of sawtimber.—Net volume of the sa log portion of live sawtimber trees in board fe International ¼-inch rule, from stump to a minimu 7 inches top diameter outside bark (d.o.b.) f softwoods and a minimum 9 inches top d.o.b. f hardwoods.

Upper stem portion.—That part of the bole sawtimber trees above the merchantable sawtimb top to a minimum top diameter of 4 inches outsi bark or to the point where the central stem brea into limbs. *Growth and mortality*

Net annual growth of growing stock.—Tl annual change in volume of sound wood in live gro ing-stock and sawtimber trees and total volume trees entering these classes through ingrowth, le volume losses resulting from natural causes.

Net annual growth of sawtimber.—The a nual change in volume of live sawtimber trees ar the total volume of trees reaching sawtimber siz less volume losses resulting from natural causes.

Mortality of growing stock.—The volume sound wood in growing-stock trees dying annuall

Mortality of sawtimber.—The net board-fo volume of sawtimber trees dying annually.

Timber removals

Timber removals from growing stock.—Th volume of sound wood in growing-stock trees r moved annually for forest products (includin roundwood products and logging residues) and fo other removals. Roundwood products are logs, bolt or other round sections cut and used from trees. Log ging residues are the unused portions of cut trees plu unused trees killed by logging. Other removals ar growing-stock trees removed but not utilized fo products or trees left standing but "removed" fro the commercial forest land classification by land us change—examples are removals from cultural opera tions such as timber stand improvement work, lan clearing, and changes in land use.

Timber removals from sawtimber.—The ne board-foot volume of live sawtimber trees removed fo

rest products annually (including roundwood products and logging residues) and for other removals.

Timber products output.—All timber products t from roundwood, and byproducts of wood manucturing plants. Roundwood products include logs, lts, or other round sections cut from growing-stock ees, cull trees, salvable dead trees, trees on nonrest land, noncommercial species, sapling-size ees, and limbwood. Byproducts from primary manufacturing plants include slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulpmills that are used as pulpwood chips or other products.

Plant byproducts.—Wood products, such as pulpwood chips, obtained incidental to production of other manufactured products.

Plant residues.—Wood materials from manufacturing plants not utilized for some product.

Table 1.--Area of land by land class, Minnesota, 1962[1/] and 1977

(In thousand acres)

Land class	1962[1/]	1977
FOREST:		
Commercial forest land:		
Jack pine	872.0	504.4
Red pine	280.6	246.9
White pine	132.0	65.6
Balsam fir	907.9	859.1
White spruce	57.3	79.2
Black spruce	1,152.3	1,041.8
Northern white-cedar	333.7	498.6
Tamarack	470.5	465.4
Oak-hickory	1,022.7	893.9
Elm-ash-cottonwood	1,286.4	738.1
Maple-basswood	1,004.3	1,283.9
Aspen	5,399.8	5,302.3
Paper birch	795.1	997.6
Balsam poplar	447.5	548.9
Nonstocked	1,249.7	169.4
Subtotal	15,411.8	13,695.1
Noncommercial forest land:		
Unproductive	2,563.1	1,835.5
Productive-reserved	470.1	1,178.6
Subtotal	3,033.2	3,014.1
Total	18,445.0	16,709.2
NONFOREST LAND:	32,760.8	34,035.6
Total	51,205.8	50,744.8

[1/] Figures have been adjusted from those published after the 1962 survey to conform to 1977 areas because of changes in survey procedures and definitions.

Table 2.--Area by land class and Forest Survey Unit, Minnesota, 1977

(In thousand acres)

Land class	All units	Aspen-Birch	Northern Pine	Central Hardwood	Prairie
FOREST LAND:					
Commercial	13,695.1	5,451.4	5,758.4	1,951.1	534.2
Productive-reserved[1/]	1,178.6	1,050.6	46.9	72.4	8.7
Unproductive	1,835.5	969.8	706.9	120.2	38.6
Total	16,709.2	7,471.8	6,512.2	2,143.7	581.5
NONFOREST LAND:					
Nonforest with trees:					
Cropland	65.7	--	20.8	35.4	9.5
Improved pasture	90.1	4.8	29.4	50.0	5.9
Wooded strips	158.9	10.6	24.6	99.4	24.3
Idle farmland	7.9	1.6	1.4	3.9	1.0
Windbreaks	151.0	13.5	12.3	103.1	22.1
Wooded pasture	135.0	23.3	22.1	80.5	9.1
Subtotal	608.6	53.8	110.6	372.3	71.9
Nonforest without trees:					
Cropland	26,421.3	357.1	2,007.2	7,218.5	16,838.5
Improved pasture	897.7	67.6	527.3	159.5	143.3
Idle farmland	47.1	15.4	22.3	5.8	3.6
Marsh	2,961.6	350.6	1,449.9	662.5	498.6
Other farm-farmstead	570.5	33.6	43.3	219.0	274.6
Urban and other	2,406.7	283.5	350.2	1,085.7	687.3
Noncensus water	122.1	--	32.1	52.2	37.8
Subtotal	33,427.0	1,107.8	4,432.3	9,403.2	18,483.7
Total	34,035.6	1,161.6	4,542.9	9,775.5	18,555.6
Total land area[2/]	50,744.8	8,633.4	11,055.1	11,919.2	19,137.1
Census water	3,058.7	715.1	1,437.7	581.9	324.0
Total gross area	53,803.5	9,348.5	12,492.8	12,501.1	19,461.1

[1/] Includes 3,000 acres of productive-deferred forest land, commercial forest land being withheld from harvest while a decision is made whether to place it in productive-reserved status.

[2/] U.S. Department of Commerce, Bureau of Census. 1970. Area measurement reports, GE-20, No. 1, 22 p.

Table 3.--Area of land and forest land by county, Minnesota, 1977

County	Land area[1/]	Forest land: All forest	Forest land: Non-commercial	Forest land: Commercial	Percent commercial forest
	- - - - - - - -Thousand acres- - - - - - - - -				
ASPEN-BIRCH					
Carlton	551.8	336.1	23.3	312.8	57
Cook	861.4	852.9	314.1	538.8	63
Koochiching	2,001.3	1,794.3	515.4	1,278.9	64
Lake	1,319.8	1,257.1	401.8	855.3	65
St. Louis	3,899.1	3,231.4	765.8	2,465.6	63
All Counties	8,633.4	7,471.8	2,020.4	5,451.4	63
NORTHERN PINE					
Aitkin	1,169.7	762.6	90.1	672.5	58
Becker	830.0	322.8	8.9	313.9	38
Beltrami	1,604.2	1,044.0	249.4	794.6	50
Cass	1,278.8	883.4	24.8	858.6	67
Clearwater	639.9	333.7	32.0	301.7	47
Crow Wing	636.5	380.7	8.8	371.9	58
Hubbard	596.2	403.2	5.2	398.0	67
Itasca	1,685.3	1,331.6	50.6	1,281.0	76
Lake of the Woods	838.8	596.1	235.5	360.6	43
Mahnomen	360.2	107.8	1.4	106.4	30
Roseau	1,072.8	232.6	40.7	191.9	18
Wadena	342.7	113.7	6.4	107.3	31
All Counties	11,055.1	6,512.2	753.8	5,758.4	52
CENTRAL HARDWOODS					
Anoka	271.0	42.9	6.3	36.6	14
Benton	257.4	28.3	2.2	26.1	10
Carver	229.9	12.3	1.9	10.4	5
Chisago	268.1	55.7	5.5	50.2	19
Dakota	368.4	19.5	3.0	16.5	5
Douglas	413.9	20.4	1.9	18.5	5
Fillmore	549.8	72.9	7.6	65.3	12
Goodhue	482.1	60.7	4.3	56.4	12
Hennepin	363.1	11.4	3.6	7.8	2
Houston	361.4	119.6	8.1	111.5	31
Isanti	280.6	54.1	7.2	46.9	17
Kanabec	335.1	134.5	5.5	129.0	39
LeSueur	281.6	11.4	1.4	10.0	4
Mille Lacs	365.6	136.2	13.4	122.8	34
Morrison	721.4	161.3	12.6	148.7	21
Olmsted	419.6	35.3	3.3	32.0	8
Otter Tail	1,256.2	200.5	14.2	186.3	15
Pine	904.7	477.6	52.0	425.6	47
Ramsey	99.0	0.1	0.1	--	0
Rice	317.6	14.1	2.0	12.1	4
Scott	225.7	16.3	2.7	13.6	6
Sherburne	275.8	62.3	5.4	56.9	21
Stearns	858.9	60.3	4.3	56.0	7
Todd	602.6	111.1	6.6	104.5	17
Wabasha	334.1	62.1	4.7	57.4	17
Washington	246.9	12.1	1.9	10.2	4
Winona	397.1	114.9	8.6	106.3	27
Wright	431.6	35.8	2.3	33.5	8
All Counties	11,919.2	2,143.7	192.6	1,951.1	16

(Table 3 continued on next page)

(Table 3 continued)

PRAIRIE

County	Land area[1/]	Forest land			Percent commercial forest
		All forest	Non-commercial	Commercial	
	-Thousand acres-				
Big Stone	313.8	2.7	0.3	2.4	1
Blue Earth	471.3	23.6	2.2	21.4	5
Brown	390.3	10.7	1.6	9.1	2
Chippewa	372.2	4.0	0.1	3.9	1
Clay	669.1	11.2	0.9	10.3	2
Cottonwood	407.0	2.6	0.1	2.5	1
Dodge	278.4	7.4	1.0	6.4	2
Faribault	455.1	6.5	0.3	6.2	1
Freeborn	448.4	5.7	0.9	4.8	1
Grant	349.6	3.0	0.1	2.9	1
Jackson	445.5	2.3	0.2	2.1	1
Kandiyohi	501.2	12.4	2.5	9.9	2
Kittson	719.0	71.9	4.4	67.5	9
Lac qui Parle	491.6	5.2	0.6	4.6	1
Lincoln	339.8	2.2	0.2	2.0	1
Lyon	453.5	5.3	0.9	4.4	1
McLeod	312.3	6.1	0.3	5.8	2
Marshall	1,145.1	142.7	14.2	128.5	11
Martin	450.1	3.8	0.2	3.6	1
Meeker	396.3	12.0	1.2	10.8	3
Mower	449.9	6.1	0.9	5.2	1
Murray	449.9	1.4	0.3	1.1	0
Nicollet	276.7	13.7	1.4	12.3	4
Nobles	455.5	0.7	--	0.7	0
Norman	566.4	23.1	0.9	22.2	4
Pennington	398.0	32.0	1.3	30.7	8
Pipestone	297.0	0.4	--	0.4	0
Polk	1,288.1	71.3	3.3	68.0	5
Pope	428.3	7.8	0.9	6.9	2
Red Lake	276.5	28.9	1.7	27.2	10
Redwood	559.4	6.7	0.5	6.2	1
Renville	626.3	8.0	0.8	7.2	1
Rock	310.4	0.5	--	0.5	0
Sibley	373.2	11.9	1.0	10.9	3
Steele	272.3	5.6	0.6	5.0	2
Stevens	357.2	1.0	--	1.0	0
Swift	473.2	5.0	0.3	4.7	1
Traverse	363.7	0.9	--	0.9	0
Waseca	265.3	5.0	0.4	4.6	2
Watonwan	276.9	1.1	--	1.1	0
Wilkin	481.1	0.5	--	0.5	0
Yellow Medicine	482.2	8.6	0.8	7.8	2
All Counties	19,137.1	581.5	47.3	534.2	3
All units	50,744.8	16,709.2	3,014.1	13,695.1	27

[1/] U.S. Department of Commerce, Bureau of Census. 1970. Area measurement reports, GE-20, No. 1, 22 p.

Table 4.--Area of commercial forest land by ownership class and Forest Survey Unit, Minnesota, 1977

(In thousand acres)

Ownership class	All units	Aspen-Birch	Northern Pine	Central Hardwood	Prairie
National Forest	1,715.1	1,152.8	562.3	--	--
Bureau of Land Mgmt.	43.9	8.1	35.8	--	--
Indian	466.8	97.5	364.9	4.4	--
Miscellaneous federal	110.5	20.7	60.5	20.3	9.0
State	2,650.5	1,132.1	1,228.7	244.7	45.0
County and municipal	2,341.6	1,185.9	1,096.7	59.0	--
Forest industry	772.0	534.7	233.8	0.5	3.0
Farmer	3,403.7	544.2	1,322.1	1,141.4	396.0
Farmer owned-leased	--	--	--	--	--
Misc. private-corp.	466.7	246.8	154.3	61.1	4.5
Misc. private-indiv.	1,712.0	523.6	696.6	418.1	73.7
Misc. priv.-corp., leased	5.7	4.0	--	--	1.7
Misc. priv.-indiv., leased	6.6	1.0	2.7	1.6	1.3
All owners	13,695.1	5,451.4	5,758.4	1,951.1	534.2

Table 5.--Area of commercial forest land by ownership class and forest type, Minnesota, 1977

(In thousand acres)

Ownership class	All types	Forest type: Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
National Forest	1,715.1	116.9	130.7	19.4	185.9	26.3	184.4	61.5
Bureau of Land Mgmt.	43.9	6.7	1.4	1.4	--	1.4	6.9	6.2
Indian	466.8	5.2	8.8	7.5	23.0	6.5	51.4	48.7
Miscellaneous federal	110.5	5.4	1.3	--	6.1	--	4.2	1.6
State	2,650.5	93.8	23.7	2.6	198.7	22.3	421.2	202.0
County and municipal	2,341.6	82.4	24.5	4.4	196.4	4.1	160.6	68.7
Forest industry	772.0	52.4	13.5	5.1	80.6	2.7	66.8	49.9
Farmer	3,403.7	80.9	21.5	16.7	75.5	7.8	69.9	25.4
Farmer owned-leased	--	--	--	--	--	--	--	--
Misc. private-corp.	466.7	12.4	3.6	1.0	32.4	--	27.2	6.6
Misc. private-indiv.	1,712.0	48.3	17.9	7.5	60.5	8.1	49.2	28.0
Misc. priv.-corp., leased	5.7	--	--	--	--	--	--	--
Misc. priv.-indiv., leased	6.6	--	--	--	--	--	--	--
All owners	13,695.1	504.4	246.9	65.6	859.1	79.2	1,041.8	498.6

(Table 5 continued)

Ownership class	Forest type: Tamarack	Oak-hickory	Elm ash-cotton-wood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
National Forest	7.2	11.1	44.6	98.7	598.5	196.5	--	33.4
Bureau of Land Mgmt.	--	--	1.6	--	13.9	--	2.8	1.6
Indian	25.5	8.6	19.0	24.9	187.2	26.9	20.3	3.3
Miscellaneous federal	5.6	6.5	14.5	11.7	33.1	8.7	8.7	3.1
State	223.7	65.8	123.3	117.2	846.6	129.9	140.4	39.3
County and municipal	73.1	39.0	122.8	163.0	1,057.9	223.9	97.4	23.4
Forest industry	10.0	10.3	38.5	40.2	315.8	49.0	29.0	8.2
Farmer	76.0	581.2	234.8	586.1	1,278.8	161.2	152.3	35.6
Farmer owned-leased	--	--	--	--	--	--	--	--
Misc. private-corp.	16.6	29.9	19.7	33.5	204.4	54.1	19.8	5.5
Misc. private-indiv.	27.7	140.2	119.3	205.7	758.0	147.4	78.2	16.0
Misc. priv.-corp., leased	--	--	--	--	5.7	--	--	--
Misc. priv.-indiv., leased	--	1.3	--	2.9	2.4	--	--	--
All owners	465.4	893.9	738.1	1,283.9	5,302.3	997.6	548.9	169.4

Table 6.--Area of commercial forest land by ownership class and site class, Minnesota, 1977

(In thousand acres)

Ownership class	All classes	Site class (cubic feet of growth/acre/year)				
		165-224	120-164	85-119	50-84	20-49
National Forest	1,715.1	--	1.5	177.3	694.5	841.8
Bureau of Land Mgmt.	43.9	--	--	4.2	14.9	24.8
Indian	466.8	1.4	8.7	78.1	151.0	227.6
Miscellaneous federal	110.5	--	--	5.8	48.3	56.4
State	2,650.5	1.4	31.5	374.4	722.4	1,520.8
County and municipal	2,341.6	1.3	46.8	468.7	919.5	905.3
Forest industry	772.0	1.2	17.5	164.8	230.5	358.0
Farmer	3,403.7	1.4	30.7	414.1	1,318.3	1,639.2
Farmer owned-leased	--	--	--	--	--	--
Misc. private-corp.	466.7	--	5.2	89.0	201.4	171.1
Misc. private-indiv.	1,712.0	--	17.7	265.5	691.1	737.7
Misc. priv.-corp., leased	5.7	--	--	1.4	4.3	--
Mics. priv.-indiv., leased	6.6	--	--	1.0	2.7	2.9
All owners	13,695.1	6.7	159.6	2,044.3	4,998.9	6,485.6

Table 7.--Area of commercial forest land by stand-size class, ownership class, and Forest Survey Unit, Minnesota, 1977

(In thousand acres)

ALL UNITS

Stand-size class	All owners	Ownership class: National Forest	Breau of Land Mgmt.	Indian	Misc. Federal	State	County & municipal	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Sawtimber	3,134.8	311.9	15.3	92.6	40.2	451.9	433.3	154.4	1,108.1	104.6	418.2	--	4.3
Poletimber	6,956.1	1,045.1	18.7	233.6	41.7	1,275.2	1,310.4	354.6	1,533.5	247.8	890.4	2.8	2.3
Sapling and seedling	3,434.8	324.7	8.3	137.3	25.4	884.1	574.5	254.8	726.7	108.9	387.2	2.9	--
Nonstocked areas	169.4	33.4	1.6	3.3	3.2	39.3	23.4	8.2	35.4	5.4	16.2	--	--
All classes	13,695.1	1,715.1	43.9	466.8	110.5	2,650.5	2,341.6	772.0	3,403.7	466.7	1,712.0	5.7	6.6
ASPEN-BIRCH													
Sawtimber	942.9	193.5	1.4	20.4	5.5	189.2	188.4	111.1	70.4	48.9	114.1	--	--
Poletimber	2,847.1	687.7	2.8	39.2	10.8	539.3	635.0	224.5	314.2	126.9	262.9	2.8	1.0
Sapling and seedling	1,596.4	251.4	3.9	37.9	4.4	397.1	342.1	194.6	155.6	67.1	141.1	1.2	--
Nonstocked areas	65.0	20.2	--	--	--	6.5	20.4	4.5	4.0	3.9	5.5	--	--
All classes	5,451.4	1,152.8	8.1	97.5	20.7	1,132.1	1,185.9	534.7	544.2	246.8	523.6	4.0	1.0
NORTHERN PINE													
Sawtimber	1,225.8	118.4	13.9	70.6	20.0	203.6	234.8	43.3	317.4	39.4	163.0	--	1.4
Poletimber	3,082.5	357.4	15.9	191.6	24.0	579.2	638.6	128.3	688.8	79.2	378.2	--	1.3
Sapling and seedling	1,379.5	73.3	4.4	99.4	15.0	413.6	220.3	58.5	310.2	35.7	149.1	--	--
Nonstocked areas	70.6	13.2	1.6	3.3	1.5	32.3	3.0	3.7	5.7	--	6.3	--	--
All classes	5,758.4	562.3	35.8	364.9	60.5	1,228.7	1,096.7	233.8	1,322.1	154.3	696.6	--	2.7
CENTRAL HARDWOOD													
Sawtimber	785.5	--	--	1.6	14.7	56.1	10.1	--	577.1	16.3	108.0	--	1.6
Poletimber	847.8	--	--	2.8	5.6	136.1	36.8	0.5	396.8	38.9	230.3	--	--
Sapling and seedling	289.9	--	--	--	--	52.0	12.1	--	146.0	4.4	75.4	--	--
Nonstocked areas	27.9	--	--	--	--	0.5	--	--	21.5	1.5	4.4	--	--
All classes	1,951.1	--	--	4.4	20.3	244.7	59.0	0.5	1,141.4	61.1	418.1	--	1.6
PRAIRIE													
Sawtimber	180.6	--	--	--	--	3.0	--	--	143.2	--	33.1	--	1.3
Poletimber	178.7	--	--	--	1.3	20.6	--	1.3	133.7	2.8	19.0	--	--
Sapling and seedling	169.0	--	--	--	6.0	21.4	--	1.7	114.9	1.7	21.6	1.7	--
Nonstocked areas	5.9	--	--	--	1.7	--	--	--	4.2	--	--	--	--
All classes	534.2	--	--	--	9.0	45.0	--	3.0	396.0	4.5	73.7	1.7	1.3

Table 8.--Area of commercial forest land by ownership class and area-condition class, Minnesota, 1977

(In thousand acres)

Ownership class	All classes	Area-condition class						
		10	20	30	40	50	60	70
National Forest	1,715.1	--	--	--	--	145.6	1,370.8	198.7
Bureau of Land Mgmt.	43.9	--	--	--	--	11.4	24.1	8.4
Indian	466.8	--	--	--	--	175.9	199.8	91.1
Miscellaneous federal	110.5	--	--	--	--	21.7	68.0	20.8
State	2,650.5	--	--	--	--	856.6	1,319.8	474.1
County and municipal	2,341.6	--	--	--	--	713.5	1,195.6	432.5
Forest industry	772.0	--	--	--	--	276.4	365.5	130.1
Farmer	3,403.7	--	--	--	--	756.6	1,775.3	871.8
Farmer owned-leased	--	--	--	--	--	--	--	--
Misc. private-corp.	466.7	--	--	--	--	98.5	260.5	107.7
Misc. private-indiv.	1,712.0	1.3	--	--	--	444.5	844.7	421.5
Misc. priv.-corp., leased	5.7	--	--	--	--	1.4	2.9	1.4
Misc. priv.-indiv., leased	6.6	--	--	--	--	3.7	2.9	--
All owners	13,695.1	1.3	--	--	--	3,505.8	7,429.9	2,758.1

Table 9.--Area of commercial forest land by ownership class and stand-volume class, Minnesota, 1977

(In thousand acres)

Ownership class	All classes	Stand-volume class (board feet[1/])		
		Less than 1,500	1,500 to 5,000	More than 5,000
National Forest	1715.1	859.4	585.0	270.7
Bureau of Land Mgmt.	43.9	24.4	16.7	2.8
Indian	466.8	300.9	129.8	36.1
Miscellaneous federal	110.5	53.9	39.2	17.4
State	2,650.5	1,808.6	707.7	134.2
County and municipal	2,341.6	1,451.3	735.2	155.1
Forest industry	772.0	485.1	229.4	57.5
Farmer	3,403.7	1,826.3	1,245.5	331.9
Farmer owned-leased	--	--	--	--
Misc. private-corp.	466.7	302.5	142.0	22.2
Misc. private-indiv.	1,712.0	1,008.2	572.3	131.5
Misc. priv.-corp., leased	5.7	4.3	1.4	--
Misc. priv.-indiv., leased	6.6	1.0	1.3	4.3
All owners	13,695.1	8,125.9	4,405.5	1,163.7

[1/]International 1/4-inch rule.

Table 10.--Area of commercial forest land by forest type, stand-size class, and Forest Survey Unit, Minnesota, 1977

(In thousand acres)

ALL UNITS

Forest type	All stands	Stand-size class			
		Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
Jack pine	504.4	177.3	247.2	79.9	--
Red pine	246.9	145.1	41.8	60.0	--
White pine	65.6	58.4	3.9	3.3	--
Balsam fir	859.1	140.0	490.5	228.6	--
White spruce	79.2	21.7	23.5	34.0	--
Black spruce	1,041.8	31.1	390.3	620.4	--
Northern white-cedar	498.6	145.5	275.5	77.6	--
Tamarack	465.4	43.5	200.3	221.6	--
Oak-hickory	893.9	452.7	360.9	80.3	--
Elm-ash-cottonwood	738.1	194.8	388.8	154.5	--
Maple-basswood	1,283.9	675.6	493.5	114.8	--
Aspen	5,302.3	791.4	3,032.3	1,478.6	--
Paper birch	997.6	142.0	758.6	97.0	--
Balsam poplar	548.9	115.7	249.0	184.2	--
Nonstocked	169.4	--	--	--	169.4
All types	13,695.1	3,134.8	6,956.1	3,434.8	169.4
ASPEN-BIRCH					
Jack pine	165.7	68.3	66.3	31.1	--
Red pine	114.4	49.2	19.9	45.3	--
White pine	33.8	32.4	--	1.4	--
Balsam fir	626.0	106.1	362.9	157.0	--
White spruce	60.1	13.0	17.1	30.0	--
Black spruce	745.7	24.0	304.4	417.3	--
Northern white-cedar	317.8	110.2	153.0	54.6	--
Tamarack	157.6	9.8	53.6	94.2	--
Oak-hickory	5.4	--	5.4	--	--
Elm-ash-cottonwood	243.7	45.0	138.8	59.9	--
Maple-basswood	214.5	106.0	79.8	28.7	--
Aspen	1,947.4	260.5	1,120.5	566.4	--
Paper birch	546.3	69.4	419.2	57.7	--
Balsam poplar	208.0	49.0	106.2	52.8	--
Nonstocked	65.0	--	--	--	65.0
All types	5,451.4	942.9	2,847.1	1,596.4	65.0
NORTHERN PINE					
Jack pine	327.4	105.9	174.6	46.9	--
Red pine	121.9	94.3	15.6	12.0	--
White pine	24.8	20.9	3.9	--	--
Balsam fir	225.6	31.6	124.4	69.6	--
White spruce	19.1	8.7	6.4	4.0	--
Black spruce	278.2	7.1	80.8	190.3	--
Northern white-cedar	180.8	35.3	122.5	23.0	--
Tamarack	276.0	26.1	132.2	117.7	--
Oak-hickory	247.4	65.5	143.5	38.4	--
Elm-ash-cottonwood	309.8	76.4	169.5	63.9	--
Maple-basswood	466.4	179.0	252.9	34.5	--
Aspen	2,541.7	452.4	1,451.4	637.9	--
Paper birch	371.2	55.9	288.3	27.0	--
Balsam poplar	297.5	66.7	116.5	114.3	--
Nonstocked	70.6	--	--	--	70.6
All types	5,758.4	1,225.8	3,082.5	1,379.5	70.6

(Table 10 continued on next page)

(Table 10 continued)

CENTRAL HARDWOOD

Forest type	All stands	Stand-size class: Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
Jack pine	11.3	3.1	6.3	1.9	--
Red pine	10.6	1.6	6.3	2.7	--
White pine	7.0	5.1	--	1.9	--
Balsam fir	7.5	2.3	3.2	2.0	--
White spruce	--	--	--	--	--
Black spruce	17.9	--	5.1	12.8	--
Northern white-cedar	--	--	--	--	--
Tamarack	30.8	7.6	14.5	8.7	--
Oak-hickory	571.8	343.2	194.0	34.6	--
Elm-ash-cottonwood	129.5	39.1	62.7	27.7	--
Maple-basswood	485.8	296.7	147.4	41.7	--
Aspen	560.2	70.1	349.1	141.0	--
Paper birch	80.1	16.7	51.1	12.3	--
Balsam poplar	10.7	--	8.1	2.6	--
Nonstocked	27.9	--	--	--	27.9
All types	1,951.1	785.5	847.8	289.9	27.9

PRAIRIE

Jack pine	--	--	--	--	--
Red pine	--	--	--	--	--
White pine	--	--	--	--	--
Balsam fir	--	--	--	--	--
White spruce	--	--	--	--	--
Black spruce	--	--	--	--	--
Northern white-cedar	--	--	--	--	--
Tamarack	1.0	--	--	1.0	--
Oak-hickory	69.3	44.0	18.0	7.3	--
Elm-ash-cottonwood	55.1	34.3	17.8	3.0	--
Maple-basswood	117.2	93.9	13.4	9.9	--
Aspen	253.0	8.4	111.3	133.3	--
Paper birch	--	--	--	--	--
Balsam poplar	32.7	--	18.2	14.5	--
Nonstocked	5.9	--	--	--	5.9
All types	534.2	180.6	178.7	169.0	5.9

Table 11.--Area of commercial forest land by county and forest type, Minnesota, 1977

(In thousand acres)

County	All types	ASPEN-BIRCH														
		Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-Basswood	Aspen	Paper birch	Balsam poplar	Nonstocked
Carlton	312.8	1.4	4.1	--	12.7	1.4	19.8	2.7	16.2	4.0	37.5	21.9	142.1	28.2	17.1	3.7
Cook	538.8	17.1	--	3.9	108.9	19.7	56.5	31.6	--	--	8.0	39.8	164.0	85.3	--	4.0
Koochiching	1,278.9	17.8	13.2	--	101.6	11.3	279.1	159.3	74.2	--	88.1	16.7	377.6	31.5	95.7	12.8
Lake	855.3	40.8	45.9	4.8	151.9	12.3	99.7	46.6	2.7	--	26.3	63.3	188.4	150.3	14.1	8.2
St. Louis	2,465.6	88.6	51.2	25.1	250.9	15.4	290.6	77.6	64.5	1.4	83.8	72.8	1,075.3	251.0	81.1	36.3
All counties	5,451.4	165.7	114.4	33.8	626.0	60.1	745.7	317.8	157.6	5.4	243.7	214.5	1,947.4	546.3	208.0	65.0
		NORTHERN PINE														
Aitkin	672.5	2.5	1.6	1.2	15.2	1.2	50.0	8.2	43.4	15.4	71.2	142.8	253.4	40.2	23.4	2.8
Becker	313.9	16.7	2.6	1.1	10.5	--	6.1	--	17.4	29.4	8.8	41.1	151.8	20.3	8.1	--
Beltrami	794.6	40.1	15.7	7.1	26.3	4.1	34.5	53.1	63.5	8.6	47.6	40.8	319.3	48.5	70.5	14.9
Cass	858.6	55.3	35.4	6.9	19.9	1.4	17.7	25.4	23.4	49.1	36.0	66.1	423.0	80.7	12.8	5.5
Clearwater	301.7	7.7	4.9	4.4	15.6	--	8.6	4.6	13.4	7.2	9.9	29.6	156.3	15.8	22.0	1.7
Crow Wing	371.9	25.4	4.1	--	2.8	--	4.2	1.2	12.0	86.7	18.5	19.6	165.9	29.0	--	2.5
Hubbard	398.0	63.5	12.9	1.4	14.1	3.3	5.9	1.4	6.5	17.3	2.5	5.7	224.9	30.2	8.4	--
Itasca	1,281.0	40.6	39.8	2.7	97.2	4.9	84.7	60.1	43.3	9.9	89.2	96.7	539.7	92.0	56.6	23.6
Lake of the Woods	360.6	22.6	1.4	--	16.5	2.7	54.9	21.2	33.6	--	7.8	--	115.1	10.2	57.8	16.8
Mahnomen	106.4	1.4	--	--	1.7	1.5	--	--	2.6	9.7	1.7	17.0	64.7	3.0	3.1	--
Roseau	191.9	15.0	--	--	5.8	--	9.2	5.6	15.0	--	13.9	5.8	85.9	1.3	31.6	2.8
Wadena	107.3	36.6	3.5	--	--	--	2.4	--	1.9	14.1	2.7	1.2	41.7	--	3.2	--
All counties	5,758.4	327.4	121.9	24.8	225.6	19.1	278.2	180.8	276.0	247.4	309.8	466.4	2,541.7	371.2	297.5	70.6

(Table 11 continued on next page)

(Table 11 continued)

CENTRAL HARDWOOD

County	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-Basswood	Aspen	Paper birch	Balsam poplar	Nonstocked
Anoka	36.6	0.3	0.3	0.1	0.1	--	--	--	0.7	11.7	4.0	11.7	5.8	0.9	0.1	0.9
Benton	26.1	0.7	0.7	0.1	--	--	--	--	0.1	9.5	1.7	7.4	4.9	0.7	0.1	0.2
Carver	10.4	--	--	0.1	--	--	--	--	0.1	3.4	1.3	4.0	1.1	0.2	--	0.2
Chisago	50.2	0.8	0.7	0.1	0.1	--	0.5	--	1.4	12.5	5.0	17.3	9.1	1.2	0.3	1.2
Dakota	16.5	--	0.2	--	--	--	--	--	0.5	3.7	2.7	5.3	3.0	0.6	--	0.5
Douglas	18.5	--	--	0.1	--	--	--	--	0.3	4.4	1.3	5.4	5.7	0.6	0.2	0.5
Fillmore	65.3	0.4	0.1	0.2	--	--	--	--	0.2	33.5	3.0	13.7	11.0	2.3	0.3	0.6
Goodhue	56.4	0.3	0.2	0.1	--	--	--	--	0.2	29.5	3.0	13.8	6.6	2.0	0.2	0.5
Hennepin	7.8	--	--	--	--	--	--	--	0.2	1.7	1.1	3.3	1.0	0.1	0.2	0.2
Houston	111.5	0.2	0.1	0.2	--	--	--	--	0.1	66.6	3.9	28.1	8.1	3.3	0.6	0.3
Isanti	46.9	1.3	1.3	0.1	0.1	--	0.8	--	2.0	11.1	4.2	12.7	10.5	1.3	0.3	1.2
Kanabec	129.0	0.1	0.4	0.2	0.2	--	0.9	--	2.9	27.0	9.8	29.4	49.4	6.5	0.5	1.7
Le Sueur	10.0	--	--	--	--	--	--	--	0.3	2.0	1.7	4.2	1.3	0.2	--	0.3
Mille Lacs	122.8	0.1	0.5	0.4	0.2	--	0.8	--	2.6	22.7	9.1	34.2	43.9	5.8	0.6	1.9
Morrison	148.7	1.1	0.9	0.3	--	--	0.4	--	2.4	57.0	9.9	35.9	32.6	5.1	0.8	2.3
Olmsted	32.0	0.1	0.1	0.1	--	--	--	--	0.2	16.1	1.7	7.2	5.1	1.0	0.1	0.3
Otter Tail	186.3	0.5	0.8	1.5	0.4	--	1.4	--	3.5	31.4	12.3	50.0	70.2	9.3	1.6	3.4
Pine	425.6	3.6	2.4	1.5	5.8	--	13.0	--	9.9	37.2	26.6	77.9	214.6	25.1	2.4	5.6
Ramsey	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Rice	12.1	--	--	--	--	--	--	--	0.1	2.3	1.6	5.7	1.8	0.2	0.1	0.3
Scott	13.6	--	--	--	--	--	--	--	0.2	3.9	2.0	5.6	1.4	0.2	--	0.3
Sherburne	56.9	0.9	1.3	1.1	0.3	--	--	--	0.2	28.5	2.8	12.6	6.7	1.7	0.3	0.5
Stearns	56.0	0.1	0.1	0.2	--	--	--	--	0.4	26.6	3.7	16.1	6.8	1.4	0.3	0.3
Todd	104.5	0.1	0.2	0.3	0.3	--	--	--	1.3	23.8	7.5	32.7	31.6	3.4	0.6	2.7
Wabasha	57.4	0.3	0.2	0.1	--	--	--	--	0.4	28.6	2.9	12.8	9.2	2.1	0.2	0.6
Washington	10.2	--	--	--	--	--	0.1	--	0.3	1.5	1.6	4.4	1.7	0.3	--	0.3
Winona	106.3	0.3	0.1	0.1	--	--	--	--	--	63.8	3.2	25.0	9.3	3.5	0.5	0.5
Wright	33.5	0.1	--	0.1	--	--	--	--	0.3	11.8	1.9	9.4	7.8	1.1	0.4	0.6
All counties	1,951.1	11.3	10.6	7.0	7.5	--	17.9	--	30.8	571.8	129.5	485.8	560.2	80.1	10.7	27.9

(Table 11 continued on next page)

(Table 11 continued)

PRAIRIE

County	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-Basswood	Aspen	Paper birch	Balsam poplar	Nonstocked
Big Stone	2.4	--	--	--	--	--	--	--	--	0.2	0.6	0.7	0.8	--	0.1	--
Blue Earth	21.4	--	--	--	--	--	--	--	--	5.0	2.2	11.7	2.0	--	0.2	0.3
Brown	9.1	--	--	--	--	--	--	--	--	2.5	1.0	4.6	0.8	--	0.1	0.1
Chippewa	3.9	--	--	--	--	--	--	--	--	0.2	1.0	1.0	1.4	--	0.2	0.1
Clay	10.3	--	--	--	--	--	--	--	--	2.0	1.6	2.0	4.0	--	0.6	0.1
Cottonwood	2.5	--	--	--	--	--	--	--	--	0.2	0.5	1.1	0.6	--	0.1	--
Dodge	6.4	--	--	--	--	--	--	--	--	2.5	0.3	3.3	0.2	--	--	0.1
Faribault	6.2	--	--	--	--	--	--	--	--	0.8	1.1	3.4	0.8	--	0.1	--
Freeborn	4.8	--	--	--	--	--	--	--	--	1.6	0.3	2.2	0.5	--	0.1	0.1
Grant	2.9	--	--	--	--	--	--	--	--	0.9	0.3	0.8	0.9	--	--	--
Jackson	2.1	--	--	--	--	--	--	--	--	0.5	0.2	1.0	0.4	--	--	--
Kandiyohi	9.9	--	--	--	--	--	--	--	--	3.5	1.3	2.7	2.0	--	0.3	0.1
Kittson	67.5	--	--	--	--	--	--	--	--	3.7	3.9	1.9	52.3	--	5.0	0.7
Lac qui Parle	4.6	--	--	--	--	--	--	--	--	0.5	1.1	1.9	1.0	--	0.1	--
Lincoln	2.0	--	--	--	--	--	--	--	--	0.5	0.2	0.9	0.4	--	--	--
Lyon	4.4	--	--	--	--	--	--	--	--	0.6	0.9	2.0	0.7	--	0.1	0.1
McLeod	5.8	--	--	--	--	--	--	--	--	1.2	0.5	3.5	0.6	--	--	--
Marshall	128.5	--	--	--	--	--	--	--	0.7	8.3	11.4	5.7	87.9	--	13.2	1.3
Martin	3.6	--	--	--	--	--	--	--	--	0.4	0.6	1.5	0.9	--	0.1	0.1
Meeker	10.8	--	--	--	--	--	--	--	--	2.7	0.7	6.6	0.4	--	0.1	0.3
Mower	5.2	--	--	--	--	--	--	--	--	1.7	0.3	2.8	0.3	--	--	0.1
Murray	1.1	--	--	--	--	--	--	--	--	0.1	0.3	0.5	0.2	--	--	--
Nicollet	12.3	--	--	--	--	--	--	--	--	2.3	1.1	7.4	1.1	--	0.1	0.3
Nobles	0.7	--	--	--	--	--	--	--	--	0.1	0.1	0.2	0.3	--	--	--
Norman	22.2	--	--	--	--	--	--	--	--	1.8	3.2	4.0	11.5	--	1.4	0.3
Pennington	30.7	--	--	--	--	--	--	--	--	2.5	2.8	3.5	19.3	--	2.4	0.2
Pipestone	0.4	--	--	--	--	--	--	--	--	0.1	0.1	0.1	0.1	--	--	--
Polk	68.0	--	--	--	--	--	--	--	0.1	8.9	7.7	13.2	32.4	--	5.1	0.6
Pope	6.9	--	--	--	--	--	--	--	0.1	1.1	1.2	1.3	2.7	--	0.4	0.1
Red Lake	27.2	--	--	--	--	--	--	--	--	2.4	2.0	2.8	17.7	--	2.1	0.2
Redwood	6.2	--	--	--	--	--	--	--	--	1.3	1.0	2.1	1.5	--	0.2	0.1
Renville	7.2	--	--	--	--	--	--	--	0.1	1.6	0.9	3.3	1.1	--	0.1	0.1
Rock	0.5	--	--	--	--	--	--	--	--	--	0.1	0.2	0.2	--	--	--
Sibley	10.9	--	--	--	--	--	--	--	--	2.8	1.0	6.0	0.9	--	0.1	0.1
Steele	5.0	--	--	--	--	--	--	--	--	1.4	0.3	2.6	0.5	--	0.1	0.1
Stevens	1.0	--	--	--	--	--	--	--	--	0.2	0.1	0.2	0.5	--	--	--
Swift	4.7	--	--	--	--	--	--	--	--	0.5	1.0	1.7	1.3	--	0.1	0.1
Traverse	0.9	--	--	--	--	--	--	--	--	0.1	0.2	0.1	0.4	--	0.1	--
Waseca	4.6	--	--	--	--	--	--	--	--	0.9	0.4	2.7	0.5	--	--	0.1
Watonwan	1.1	--	--	--	--	--	--	--	--	--	0.4	0.7	--	--	--	--
Wilkin	0.5	--	--	--	--	--	--	--	--	--	0.1	--	0.4	--	--	--
Yellow Medicine	7.8	--	--	--	--	--	--	--	--	1.7	1.1	3.3	1.5	--	0.1	0.1
All counties	534.2	--	--	--	--	--	--	--	1.0	69.3	55.1	117.2	253.0	--	32.7	5.9
All units	13,695.1	504.4	246.9	65.6	859.1	79.2	1,041.8	498.6	465.4	893.9	738.1	1,283.9	5,302.3	997.6	548.9	169.4

Table 12.--Area of commercial forest land by county and stand-size class, Minnesota, 1977

(In thousand acres)

County	All stands	Stand-size class: Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
ASPEN-BIRCH					
Carlton	312.8	38.4	162.2	108.5	3.7
Cook	538.8	142.5	295.9	96.4	4.0
Koochiching	1,278.9	193.7	589.2	483.2	12.8
Lake	855.3	194.8	429.9	222.4	8.2
St. Louis	2,465.6	373.5	1,369.9	685.9	36.3
All counties	5,451.4	942.9	2,847.1	1,596.4	65.0
NORTHERN PINE					
Aitkin	672.5	142.0	331.1	196.6	2.8
Becker	313.9	81.1	178.9	53.9	--
Beltrami	794.6	154.8	428.6	196.3	14.9
Cass	858.6	189.0	515.3	148.8	5.5
Clearwater	301.7	77.5	150.4	72.1	1.7
Crow Wing	371.9	81.7	223.4	64.3	2.5
Hubbard	398.0	71.5	242.8	83.7	--
Itasca	1,281.0	308.5	677.2	271.7	23.6
Lake of the Woods	360.6	49.6	144.9	149.3	16.8
Mahnomen	106.4	22.4	56.5	27.5	--
Roseau	191.9	29.7	72.3	87.1	2.8
Wadena	107.3	18.0	61.1	28.2	--
All counties	5,758.4	1,225.8	3,082.5	1,379.5	70.6
CENTRAL HARDWOOD					
Anoka	36.6	19.5	10.6	5.6	0.9
Benton	26.1	13.1	8.3	4.5	0.2
Carver	10.4	6.6	2.4	1.2	0.2
Chisago	50.2	24.1	17.1	7.9	1.1
Dakota	16.5	7.5	6.7	1.8	0.5
Douglas	18.5	6.5	8.0	3.5	0.5
Fillmore	65.3	35.4	22.5	6.8	0.6
Goodhue	56.4	32.2	18.6	5.1	0.5
Hennepin	7.8	4.6	1.9	0.9	0.4
Houston	111.5	71.7	29.7	9.7	0.4
Isanti	46.9	17.8	18.7	9.2	1.2
Kanabec	129.0	41.2	68.8	17.3	1.7
Le Sueur	10.0	5.8	2.9	1.0	0.3
Mille Lacs	122.8	39.1	64.6	17.2	1.9
Morrison	148.7	68.9	55.9	21.6	2.3
Olmsted	32.0	18.0	10.0	3.7	0.3
Otter Tail	186.3	53.3	101.0	28.6	3.4
Pine	425.6	84.9	246.1	89.0	5.6
Ramsey	--	--	--	--	--
Rice	12.1	7.2	3.3	1.3	0.3
Scott	13.6	8.6	3.2	1.4	0.4
Sherburne	56.9	31.2	17.0	8.4	0.3
Stearns	56.0	33.6	15.5	6.6	0.3
Todd	104.5	37.7	47.1	17.1	2.6
Wabasha	57.4	30.7	19.9	6.0	0.8
Washington	10.2	5.6	3.2	1.2	0.2
Winona	106.3	66.0	30.8	9.1	0.4
Wright	33.5	14.7	14.0	4.2	0.6
All counties	1,951.1	785.5	847.8	289.9	27.9

(Table 12 continued on next page)

(Table 12 continued)

PRAIRIE

County	All stands	Stand-size class: Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
Big Stone	2.4	1.0	0.7	0.7	--
Blue Earth	21.4	15.3	3.3	2.5	0.3
Brown	9.1	6.5	1.5	1.0	0.1
Chippewa	3.9	1.3	1.3	1.2	0.1
Clay	10.3	3.7	3.2	3.3	0.1
Cottonwood	2.5	1.2	0.9	0.4	--
Dodge	6.4	5.0	0.9	0.4	0.1
Faribault	6.2	4.0	1.3	0.9	--
Freeborn	4.8	3.3	0.8	0.6	0.1
Grant	2.9	1.4	1.1	0.4	--
Jackson	2.1	1.4	0.5	0.2	--
Kandiyohi	9.9	6.0	2.1	1.7	0.1
Kittson	67.5	6.3	28.0	32.5	0.7
Lac qui Parle	4.6	2.3	1.2	1.1	--
Lincoln	2.0	1.4	0.5	0.1	--
Lyon	4.4	2.3	1.1	0.9	0.1
McLeod	5.8	4.3	1.0	0.5	--
Marshall	128.5	16.7	47.7	62.9	1.2
Martin	3.6	2.0	1.1	0.4	0.1
Meeker	10.8	8.8	0.7	1.0	0.3
Mower	5.2	4.0	0.8	0.3	0.1
Murray	1.1	0.6	0.3	0.2	--
Nicollet	12.3	9.3	1.4	1.3	0.3
Nobles	0.7	0.3	0.3	0.1	--
Norman	22.2	6.4	9.6	5.9	0.3
Pennington	30.7	6.3	14.3	9.9	0.2
Pipestone	0.4	0.2	0.2	--	--
Polk	68.0	20.7	26.1	20.5	0.7
Pope	6.9	2.4	2.4	2.0	0.1
Red Lake	27.2	5.3	13.0	8.7	0.2
Redwood	6.2	3.1	1.8	1.2	0.1
Renville	7.2	4.5	1.5	1.1	0.1
Rock	0.5	0.2	0.2	0.1	--
Sibley	10.9	8.0	1.8	1.0	0.1
Steele	5.0	3.6	0.8	0.5	0.1
Stevens	1.0	0.4	0.4	0.2	--
Swift	4.7	2.0	1.6	1.0	0.1
Traverse	0.9	0.3	0.3	0.3	--
Waseca	4.6	3.5	0.5	0.5	0.1
Watonwan	1.1	0.6	0.2	0.3	--
Wilkin	0.5	0.1	0.1	0.3	--
Yellow Medicine	7.8	4.6	2.2	0.9	0.1
All counties	534.2	180.6	178.7	169.0	5.9
All units	13,695.1	3,134.8	6,956.1	3,434.8	169.4

Table 13.--Area of commercial forest land by forest type, stand-size class, and site class, Minnesota, 1977

(In thousand acres)

Forest type and stand-size class	All classes	Site class (cubic feet of growth/acre/year)					
		225 or more	165-224	120-164	85-119	50-84	20-49
Jack pine							
Sawtimber	177.3	--	--	1.4	3.8	77.3	94.8
Poletimber	247.2	--	--	--	10.4	100.8	136.0
Sapling & seedling	79.9	--	--	--	--	40.4	39.5
All stands	504.4	--	--	1.4	14.2	218.5	270.3
Red pine							
Sawtimber	145.1	--	--	1.4	46.7	72.5	24.5
Poletimber	41.8	--	--	4.0	13.7	10.3	13.8
Sapling & seedling	60.0	--	--	--	6.9	30.8	22.3
All stands	246.9	--	--	5.4	67.3	113.6	60.6
White pine							
Sawtimber	58.4	--	2.8	8.6	21.8	12.3	12.9
Poletimber	3.9	--	--	--	3.9	--	--
Sapling & seedling	3.3	--	--	--	3.3	--	--
All stands	65.6	--	2.8	8.6	29.0	12.3	12.9
Balsam fir							
Sawtimber	140.0	--	2.7	24.5	57.7	27.3	27.8
Poletimber	490.5	--	1.2	37.7	174.4	125.3	151.9
Sapling & seedling	228.6	--	--	16.3	54.0	61.3	97.0
All stands	859.1	--	3.9	78.5	286.1	213.9	276.7
White spruce							
Sawtimber	21.7	--	--	--	3.9	12.6	5.2
Poletimber	23.5	--	--	--	1.7	16.7	5.1
Sapling & seedling	34.0	--	--	--	5.9	15.5	12.6
All stands	79.2	--	--	--	11.5	44.8	22.9
Black spruce							
Sawtimber	31.1	--	--	--	--	2.6	28.5
Poletimber	390.3	--	--	--	6.9	20.2	363.2
Sapling & seedling	620.4	--	--	--	1.3	14.8	604.3
All stands	1,041.8	--	--	--	8.2	37.6	996.0
Northern white-cedar							
Sawtimber	145.5	--	--	--	--	2.8	142.7
Poletimber	275.5	--	--	--	--	17.1	258.4
Sapling & seedling	77.6	--	--	--	--	--	77.6
All stands	498.6	--	--	--	--	19.9	478.7

(Table 13 continued on next page)

(Table 13 continued)

Forest type and stand-size class	All classes	Site class (cubic feet of growth/acre/year) 225 or more	165-224	120-164	85-119	50-84	20-49
Tamarack							
Sawtimber	43.5	--	--	--	1.3	12.1	30.1
Poletimber	200.3	--	--	--	2.0	33.6	164.7
Sapling & seedling	221.6	--	--	--	--	19.4	202.2
All stands	465.4	--	--	--	3.3	65.1	397.0
Oak-hickory							
Sawtimber	452.7	--	--	2.8	10.0	134.6	305.3
Poletimber	360.9	--	--	--	14.7	118.8	227.4
Sapling & seedling	80.3	--	--	--	--	20.7	59.6
All stands	893.9	--	--	2.8	24.7	274.1	592.3
Elm-ash-cottonwood							
Sawtimber	194.8	--	--	--	6.3	37.2	151.3
Poletimber	388.8	--	--	--	1.1	25.8	361.9
Sapling & seedling	154.5	--	--	--	--	4.6	149.9
All stands	738.1	--	--	--	7.4	67.6	663.1
Maple-basswood							
Sawtimber	675.6	--	--	--	30.6	245.2	399.8
Poletimber	493.5	--	--	--	29.4	130.6	333.5
Sapling & seedling	114.8	--	--	--	1.1	23.1	90.6
All stands	1,283.9	--	--	--	61.1	398.9	823.9
Aspen							
Sawtimber	791.4	--	--	27.3	253.4	440.8	69.9
Poletimber	3,032.3	--	--	28.6	985.0	1,614.6	404.1
Sapling & seedling	1,478.6	--	--	4.2	210.0	828.0	436.4
All stands	5,302.3	--	--	60.1	1,448.4	2,883.4	910.4
Paper birch							
Sawtimber	142.0	--	--	--	2.9	51.1	88.0
Poletimber	758.6	--	--	1.4	6.7	259.0	491.5
Sapling & seedling	97.0	--	--	--	1.3	22.1	73.6
All stands	997.6	--	--	1.4	10.9	332.2	653.1
Balsam poplar							
Sawtimber	115.7	--	--	--	22.3	69.5	23.9
Poletimber	249.0	--	--	1.4	34.3	126.5	86.8
Sapling & seedling	184.2	--	--	--	10.1	90.0	84.1
All stands	548.9	--	--	1.4	66.7	286.0	194.8
Nonstocked	169.4	--	--	--	5.5	31.0	132.9
All types							
Sawtimber	3,134.8	--	5.5	66.0	460.7	1,197.9	1,404.7
Poletimber	6,956.1	--	1.2	73.1	1,284.2	2,599.3	2,998.3
Sapling & seedling	3,434.8	--	--	20.5	293.9	1,170.7	1,949.7
Nonstocked	169.4	--	--	--	5.5	31.0	132.9
All stands	13,695.1	--	6.7	159.6	2,044.3	4,998.9	6,485.6

Table 14.--Area of commercial forest land by forest type and stand-age class, Minnesota, 1977

(In thousand acres)

Forest type	All ages	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	504.4	22.7	19.0	64.5	98.9	114.8	98.5	52.4	8.0	12.2	10.7	2.7	--	--
Red pine	246.9	10.3	38.7	12.0	28.0	19.9	16.6	15.6	47.5	21.6	34.0	2.7	--	--
White pine	65.6	2.1	3.3	--	1.3	8.9	4.2	9.8	8.8	3.9	17.6	5.7	--	--
Balsam fir	859.1	42.1	68.4	78.2	101.6	221.0	178.2	109.5	37.1	11.2	9.1	2.7	--	--
White spruce	79.2	14.2	7.2	4.8	8.2	18.8	14.6	3.9	1.2	2.5	2.7	1.1	--	--
Black spruce	1,041.8	47.5	103.1	174.0	164.4	117.6	130.6	72.7	80.9	62.2	59.2	17.1	12.5	--
Northern white-cedar	498.6	3.0	10.3	24.8	21.7	18.1	40.8	61.7	52.3	61.3	69.5	56.9	74.1	4.1
Tamarack	465.4	30.5	78.6	49.0	31.2	38.4	68.5	26.9	32.2	35.3	9.0	38.1	26.5	1.2
Oak-hickory	893.9	28.2	38.6	13.4	64.8	139.7	129.6	141.0	100.0	88.8	92.4	49.8	7.6	--
Elm-ash-cottonwood	738.1	46.8	51.1	47.1	40.0	78.4	120.5	89.1	69.7	73.6	70.1	32.3	19.4	--
Maple-basswood	1,283.9	30.3	50.8	41.2	95.9	200.5	234.3	191.5	156.2	91.0	100.6	58.6	33.0	--
Aspen	5,302.3	679.1	518.0	475.8	904.6	1,253.9	923.0	348.8	125.0	53.2	15.0	4.5	1.4	--
Paper birch	997.6	31.8	59.9	34.5	119.5	263.7	236.2	116.6	72.9	43.7	11.9	6.9	--	--
Balsam poplar	548.9	65.4	78.0	43.6	90.4	120.9	78.5	38.3	25.3	7.1	1.4	--	--	--
Nonstocked	169.4	156.3	3.9	1.6	1.3	4.9	--	--	1.4	--	--	--	--	--
All types	13,695.1	1,210.3	1,128.9	1,064.5	1,771.8	2,619.5	2,274.1	1,277.8	818.5	567.6	503.2	279.1	174.5	5.3

Table 15.--Area of commercial forest land by forest type and area-condition class, Minnesota, 1977

(In thousand acres)

Forest type	All classes	Area-condition class						
		10	20	30	40	50	60	70
Jack pine	504.4	--	--	--	--	154.0	311.8	38.6
Red pine	246.9	--	--	--	--	118.5	116.1	12.3
White pine	65.6	--	--	--	--	25.7	35.2	4.7
Balsam fir	859.1	--	--	--	--	225.7	497.6	135.8
White spruce	79.2	--	--	--	--	17.8	44.3	17.1
Black spruce	1,041.8	--	--	--	--	367.9	519.7	154.2
Northern white-cedar	498.6	--	--	--	--	196.0	234.9	67.7
Tamarack	465.4	--	--	--	--	75.6	230.4	159.4
Oak-hickory	893.9	--	--	--	--	227.5	495.9	170.5
Elm-ash-cottonwood	738.1	--	--	--	--	189.6	322.0	226.5
Maple-basswood	1,283.9	--	--	--	--	285.0	685.5	313.4
Aspen	5,302.3	1.3	--	--	--	1,255.4	3,050.2	995.4
Paper birch	997.6	--	--	--	--	238.6	600.9	158.1
Balsam poplar	548.9	--	--	--	--	128.5	265.2	155.2
Nonstocked	169.4	--	--	--	--	--	20.2	149.2
All types	13,695.1	1.3	--	--	--	3,505.8	7,429.9	2,758.1

Table 16.--Area of commercial forest land by forest type, site-index class, and Forest Survey Unit, Minnesota, 1977

(In thousand acres)

ALL UNITS

Forest type	All classes	Site-index class (feet)								
		11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91+
ack pine	504.4	--	--	18.2	112.4	194.3	132.7	40.0	5.4	1.4
ed pine	246.9	--	--	5.8	36.4	118.2	42.7	43.8	--	--
hite pine	65.6	--	--	3.7	18.8	29.5	10.7	2.9	--	--
alsam fir	859.1	--	18.6	179.3	316.6	250.4	71.2	19.1	3.9	--
hite spruce	79.2	--	--	5.8	32.7	23.8	16.9	--	--	--
lack spruce	1,041.8	27.2	369.8	375.1	223.9	37.6	6.9	1.3	--	--
orthern white-cedar	498.6	85.8	278.0	95.2	25.7	10.0	3.9	--	--	--
amarack	465.4	4.5	91.6	168.1	132.8	52.3	12.8	3.3	--	--
ak-hickory	893.9	--	7.5	164.3	307.2	225.7	134.9	39.5	12.0	2.8
lm-ash-cottonwood	738.1	--	3.2	136.3	218.8	259.3	82.5	30.6	5.9	1.5
aple-basswood	1,283.9	--	--	63.4	303.0	465.1	316.5	103.8	32.1	--
spen	5,302.3	1.4	12.3	73.1	397.7	1,225.1	1,780.0	1,286.2	466.4	60.1
aper birch	997.6	--	3.0	47.0	186.7	388.9	290.1	69.5	11.0	1.4
alsam poplar	548.9	--	--	25.4	111.2	134.1	169.9	73.7	30.4	4.2
onstocked	169.4	4.3	20.8	31.1	51.1	36.1	20.6	5.4	--	--
All types	13,695.1	123.2	804.8	1,391.8	2,475.0	3,450.4	3,092.3	1,719.1	567.1	71.4
ASPEN-BIRCH										
ack pine	165.7	--	--	5.4	55.9	78.5	20.7	5.2	--	--
ed pine	114.4	--	--	1.3	22.1	66.1	21.0	3.9	--	--
hite pine	33.8	--	--	3.7	15.0	11.6	3.5	--	--	--
alsam fir	626.0	--	11.0	106.0	245.6	195.0	56.2	9.5	2.7	--
hite spruce	60.1	--	--	5.8	21.7	21.0	11.6	--	--	--
lack spruce	745.7	21.6	248.3	270.1	169.9	29.2	5.3	1.3	--	--
orthern white-cedar	317.8	52.0	182.9	54.4	17.9	6.7	3.9	--	--	--
marack	157.6	1.2	40.8	51.5	44.4	17.0	2.7	--	--	--
k-hickory	5.4	--	--	--	1.2	1.4	1.4	1.4	--	--
m-ash-cottonwood	243.7	--	--	57.6	97.2	75.4	10.5	3.0	--	--
ple-basswood	214.5	--	--	14.2	75.0	82.6	39.0	2.7	1.0	--
pen	1,947.4	--	8.9	20.3	156.0	530.7	698.2	391.8	118.9	22.6
per birch	546.3	--	1.4	36.7	112.0	223.5	144.0	27.2	1.5	--
lsam poplar	208.0	--	--	8.6	28.8	52.2	64.2	33.4	18.0	2.8
nstocked	65.0	--	3.5	9.3	33.7	7.2	8.4	2.9	--	--
All types	5,451.4	74.8	496.8	644.9	1,096.4	1,398.1	1,090.6	482.3	142.1	25.4
NORTHERN PINE										
ck pine	327.4	--	--	12.8	54.6	112.7	109.8	30.7	5.4	1.4
d pine	121.9	--	--	4.5	14.3	47.4	17.7	38.0	--	--
ite pine	24.8	--	--	--	2.5	15.3	5.6	1.4	--	--
lsam fir	225.6	--	7.6	71.3	69.6	51.3	15.0	9.6	1.2	--
ite spruce	19.1	--	--	--	11.0	2.8	5.3	--	--	--
ack spruce	278.2	5.6	120.0	91.5	51.1	8.4	1.6	--	--	--
rthern white-cedar	180.8	33.8	95.1	40.8	7.8	3.3	--	--	--	--
marack	276.0	3.3	49.1	113.2	71.1	30.7	7.3	1.3	--	--
k-hickory	247.4	--	4.6	34.9	92.8	67.0	34.5	9.4	4.2	--
m-ash-cottonwood	309.8	--	1.4	56.3	82.6	119.1	39.2	10.1	1.1	--
ple-basswood	466.4	--	--	21.7	100.1	171.9	116.8	39.9	16.0	--
pen	2,541.7	1.4	1.8	36.9	139.9	440.0	808.1	743.0	333.1	37.5
per birch	371.2	--	--	4.9	54.8	143.1	122.0	35.5	9.5	1.4
lsam poplar	297.5	--	--	12.3	65.5	68.6	98.5	38.8	12.4	1.4
nstocked	70.6	4.3	15.8	11.8	10.3	18.1	7.8	2.5	--	--
All types	5,758.4	48.4	295.4	512.9	828.0	1,299.7	1,389.2	960.2	382.9	41.7

(Table 16 continued on next page)

(Table 16 continued)

CENTRAL HARDWOODS

Forest type	All classes	Site-index class (feet)								
		11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91+
Jack pine	11.3	--	--	--	1.9	3.1	2.2	4.1	--	--
Red pine	10.6	--	--	--	--	4.7	4.0	1.9	--	--
White pine	7.0	--	--	--	1.3	2.6	1.6	1.5	--	--
Balsam fir	7.5	--	--	2.0	1.4	4.1	--	--	--	--
White spruce	--	--	--	--	--	--	--	--	--	--
Black spruce	17.9	--	1.5	13.5	2.9	--	--	--	--	--
Northern white-cedar	--	--	--	--	--	--	--	--	--	--
Tamarack	30.8	--	0.7	3.4	17.3	4.6	2.8	2.0	--	--
Oak-hickory	571.8	--	1.6	98.2	195.2	144.6	92.9	28.7	7.8	2.8
Elm-ash-cottonwood	129.5	--	1.8	13.5	27.3	45.8	21.3	15.0	4.8	--
Maple-basswood	485.8	--	--	20.5	105.3	167.6	135.0	43.8	13.6	--
Aspen	560.2	--	1.6	2.5	36.2	153.1	223.6	128.8	14.4	--
Paper birch	80.1	--	1.6	5.4	19.9	22.3	24.1	6.8	--	--
Balsam poplar	10.7	--	--	1.5	2.9	3.2	1.6	1.5	--	--
Nonstocked	27.9	--	1.5	10.0	2.6	9.4	4.4	--	--	--
All types	1,951.1	--	10.3	170.5	414.2	565.1	513.5	234.1	40.6	2.8
PRAIRIE										
Jack pine	--	--	--	--	--	--	--	--	--	--
Red pine	--	--	--	--	--	--	--	--	--	--
White pine	--	--	--	--	--	--	--	--	--	--
Balsam fir	--	--	--	--	--	--	--	--	--	--
White spruce	--	--	--	--	--	--	--	--	--	--
Black spruce	--	--	--	--	--	--	--	--	--	--
Northern white-cedar	--	--	--	--	--	--	--	--	--	--
Tamarack	1.0	--	1.0	--	--	--	--	--	--	--
Oak-hickory	69.3	--	1.3	31.2	18.0	12.7	6.1	--	--	--
Elm-ash-cottonwood	55.1	--	--	8.9	11.7	19.0	11.5	2.5	--	1.5
Maple-basswood	117.2	--	--	7.0	22.6	43.0	25.7	17.4	1.5	--
Aspen	253.0	--	--	13.4	65.6	101.3	50.1	22.6	--	--
Paper birch	--	--	--	--	--	--	--	--	--	--
Balsam poplar	32.7	--	--	3.0	14.0	10.1	5.6	--	--	--
Nonstocked	5.9	--	--	--	4.5	1.4	--	--	--	--
All types	534.2	--	2.3	63.5	136.4	187.5	99.0	42.5	1.5	1.5

Table 17.--Area of commercial forest land by forest type and basal-area class, Minnesota, 1977

(In thousand acres)

Forest type	All classes	Basal-area class (square feet per acre)									
		0-20	21-40	41-60	61-80	81-100	101-120	121-140	141-160	161-180	181+
Jack pine	504.4	10.1	31.3	65.3	122.1	115.6	97.5	27.4	15.6	19.5	--
Red pine	246.9	8.2	37.7	21.0	19.5	70.3	18.0	27.0	11.5	18.8	14.9
White pine	65.6	1.9	1.4	--	15.5	13.0	19.7	4.8	7.2	2.1	--
Balsam fir	859.1	81.1	88.0	137.2	150.3	139.1	99.6	65.6	43.5	36.7	18.0
White spruce	79.2	20.0	4.1	19.7	11.6	16.6	--	5.5	1.7	--	--
Black spruce	1,041.8	127.9	130.2	218.2	184.4	152.8	103.0	83.2	18.8	17.4	5.9
Northern white-cedar	498.6	4.1	25.1	35.5	51.1	64.5	84.7	89.0	43.8	46.5	54.3
Tamarack	465.4	72.8	81.3	146.3	86.5	48.6	15.9	14.0	--	--	--
Oak-hickory	893.9	14.7	52.2	129.9	193.0	232.2	155.0	89.8	19.4	7.7	--
Elm-ash-cottonwood	738.1	47.1	82.3	126.6	125.7	127.0	110.5	87.0	20.0	4.8	7.1
Maple-basswood	1,283.9	14.8	74.2	172.2	229.5	271.4	283.0	126.8	82.8	16.1	13.1
Aspen	5,302.3	360.7	558.5	1,080.8	975.5	860.1	758.0	384.5	185.1	87.1	52.0
Paper birch	997.6	33.0	78.9	143.1	192.5	216.1	156.5	106.3	38.8	32.4	--
Balsam poplar	548.9	66.3	84.3	128.0	94.9	72.7	48.7	34.3	13.8	1.4	4.5
Nonstocked	169.4	74.2	33.8	42.5	13.3	1.2	2.8	1.6	--	--	--
All types	13,695.1	936.9	1,363.3	2,466.3	2,465.4	2,401.2	1,952.9	1,146.8	502.0	290.5	169.8

Table 18.--Area of commercial forest land by stocking class of growing-stock trees and stand-size class, Minnesota, 1977

(In thousand acres)

Percent stocking class	All stands	Stand-size class			
		Sawtimber stands	Poletimber stands	Sapling and Seedling stands	Nonstocked areas
Less than 18	165.5	1.6	7.3	7.4	149.2
18 to 60	2,725.3	614.4	1,213.7	897.2	--
61 to 100	7,480.7	1,734.3	3,924.0	1,802.2	20.2
101 to 133	3,006.1	715.5	1,660.3	630.3	--
134 or more	317.5	69.0	150.8	97.7	--
All classes	13,695.1	3,134.8	6,956.1	3,434.8	169.4

Table 19.--Area of commercial forest land by stocking class based on selected stand components, Minnesota, 1977

(In thousand acres)

Stocking percentage	All trees	Stocking classified in terms of			
		Growing-stock trees			Rough and rotten trees
		Total	Desirable	Acceptable	
0-10	15.6	69.2	13,294.5	73.3	4,846.2
11-20	49.7	165.3	279.2	172.5	3,350.3
21-30	104.8	315.9	87.0	319.6	3,308.0
31-40	202.3	550.1	16.0	592.4	1,170.5
41-50	376.4	690.8	11.5	731.5	553.9
51-60	520.8	1,098.9	5.6	2,302.3	270.7
61-70	661.3	2,456.3	--	1,396.3	117.5
71-80	1,003.9	1,570.4	--	1,645.8	42.8
81-90	1,299.4	1,725.9	--	1,721.4	15.0
91-100	2,823.3	1,729.4	--	1,677.6	2.4
101-110	1,788.3	1,299.1	1.3	1,229.0	9.4
111-120	1,739.0	973.4	--	900.1	4.2
121-130	1,432.6	613.4	--	553.3	1.3
131-140	979.3	277.0	--	238.2	--
141-150	513.5	115.6	--	100.3	2.9
151-160	184.9	44.4	--	41.5	--
161+	--	--	--	--	--
Total	13,695.1	13,695.1	13,695.1	13,695.1	13,695.1

Table 20.--Area of noncommercial forest land by ownership class, Minnesota, 1977

(In thousand acres)

Ownership class	All areas	Productive-reserved areas[1/]	Unproductive areas
National forest	884.3	758.7	125.6
Other federal	253.8	126.7	127.1
State, county and municipal	1,560.3	281.6	1,278.7
Forest industry	35.2	--	35.2
Farmer	211.1	--	211.1
Miscellaneous private	69.4	11.6	57.8
All owners	3,014.1	1,178.6	1,835.5

[1/] Includes 3,000 acres of productive-deferred forest land, commercial forest land being withheld from harvest while a decision is made whether to place it in productive-reserved status.

Table 21.--Area of noncommercial forest land by forest type, Minnesota, 1977

(In thousand acres)

Forest type	All areas	Productive-reserved areas[1/]	Unproductive areas
Jack pine	211.0	208.2	2.8
Red-white pine	79.4	71.9	7.5
Spruce-fir	171.9	104.7	67.2
Black spruce	1,101.1	68.7	1,032.4
Northern white-cedar	148.6	12.6	136.0
Tamarack	177.0	3.2	173.8
Oak-hickory	111.6	11.4	100.2
Elm-ash-cottonwood	225.9	38.3	187.6
Maple-basswood	30.7	23.1	7.6
Aspen-birch	743.0	633.9	109.1
Nonstocked	13.9	2.6	11.3
All types	3,014.1	1,178.6	1,835.5

[1/] Includes 3,000 acres of productive-deferred forest land, commercial forest land being withheld from harvest while a decision is made whether to place it in productive-reserved status.

Table 22.--Number of all live trees on commercial forest land by species group and diameter class, Minnesota, 1977

(In thousand trees)

Species	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:															
White pine	32,257	8,834	8,528	4,691	2,318	2,661	1,282	1,161	1,066	755	315	268	334	41	3
Red pine	73,561	25,131	14,378	10,998	8,262	4,944	3,129	2,331	1,932	1,307	571	431	143	4	--
Jack pine	185,093	37,536	47,591	42,157	31,710	15,937	7,078	2,165	772	111	25	8	3	--	--
White spruce	63,944	26,353	14,163	10,920	5,202	3,161	1,925	1,055	644	292	145	57	27	--	--
Black spruce	844,736	381,474	298,102	121,886	33,432	8,141	1,242	349	73	22	13	2	--	--	--
Balsam fir	1,067,328	553,293	286,001	143,547	57,509	19,709	5,514	1,350	286	109	7	3	--	--	--
Tamarack	234,943	88,921	74,230	46,750	17,574	5,243	1,719	379	95	25	5		2	--	--
Northern white-cedar	303,026	95,138	78,740	63,277	34,583	16,913	8,491	3,537	1,374	611	245	73	42	2	--
Other softwoods	9,568	4,789	2,917	1,182	427	138	62	30	12	4	6	1	--	--	--
Total	2,814,456	1,221,469	824,650	445,408	191,017	76,847	30,442	12,357	6,254	3,236	1,332	843	551	47	3
HARDWOODS:															
Select white oak	183,116	72,398	45,305	25,664	15,174	9,964	6,374	3,541	2,276	1,047	628	336	358	49	2
Select red oak	123,680	24,473	20,155	24,882	20,566	13,696	8,341	5,168	2,953	1,648	846	466	419	65	2
Other red oak	1,601	378	138	307	185	132	93	117	95	61	42	26	26	1	--
Hickory	14,839	9,663	2,090	1,574	671	425	219	125	48	13	9	2	--	--	--
Yellow birch	8,295	3,685	1,667	920	649	361	381	277	100	111	41	46	50	7	--
Hard maple	292,080	169,658	68,806	27,247	10,975	7,063	3,475	2,290	1,353	709	272	113	113	5	1
Soft maple	295,188	157,680	84,161	33,503	12,519	3,742	1,682	814	485	270	127	64	89	40	12
Ash	546,325	299,291	122,613	65,999	32,279	15,644	6,017	2,695	1,124	377	143	65	66	10	2
Balsam poplar	301,134	137,775	66,828	40,885	27,408	15,419	7,745	3,111	1,246	478	152	49	36	1	1
Paper birch	716,495	237,213	200,915	145,373	80,534	33,880	12,266	3,921	1,491	563	212	54	73	--	--
Bigtooth aspen	45,378	11,793	7,349	7,904	8,431	5,557	2,606	1,095	409	165	49	18	2	--	--
Quaking aspen	1,745,329	854,510	316,809	219,851	170,852	103,274	50,064	19,218	6,935	2,581	843	268	122	2	--
Basswood	170,899	70,218	36,510	25,426	16,993	9,973	5,453	2,840	1,633	903	467	233	219	29	2
Elm	202,765	93,081	44,515	24,797	16,133	9,268	5,584	3,333	2,330	1,503	778	545	683	187	28
Select hardwoods	25,825	15,452	4,925	2,602	1,120	738	467	244	164	71	20	6	11	5	--
Other hardwoods	50,863	24,834	11,439	5,840	3,522	2,121	1,367	678	427	215	144	112	92	53	19
Noncommercial species	174,774	139,219	26,890	6,724	1,437	311	118	40	22	3	7	--	1	2	--
Total	4,898,586	2,321,321	1,061,115	659,498	419,448	231,568	112,252	49,507	23,091	10,718	4,780	2,403	2,360	456	69
All species	7,713,042	3,542,790	1,885,765	1,104,906	610,465	308,415	142,694	61,864	29,345	13,954	6,112	3,246	2,911	503	72

Table 23.--Number of growing-stock trees on commercial forest land by species group and diameter class, Minnesota, 1977

(In thousand trees)

Species	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0+	39.0+
SOFTWOODS:															
White pine	26,402	6,506	7,088	3,777	1,906	2,305	1,145	1,121	903	734	309	254	315	36	3
Red pine	69,662	22,599	13,812	10,547	8,071	4,862	3,099	2,305	1,934	1,296	566	426	142	3	--
Jack pine	157,327	25,291	39,156	38,671	29,559	15,116	6,730	1,990	689	99	15	8	3	--	--
White spruce	58,356	22,217	13,471	10,661	4,882	3,057	1,879	1,044	640	279	142	57	27	--	--
Black spruce	736,707	307,334	272,790	114,946	32,220	7,784	1,185	342	69	22	13	2	--	--	--
Balsam fir	932,749	452,411	266,055	134,837	54,558	18,228	5,095	1,225	250	80	7	3	--	--	--
Tamarack	199,915	75,409	62,966	39,817	15,464	4,429	1,428	314	70	16	--	--	2	--	--
Northern white-cedar	232,128	74,226	65,267	46,147	25,307	11,716	5,424	2,435	974	386	174	40	31	1	--
Other	6,266	2,987	1,857	878	407	76	48	9	4	--	--	--	--	--	--
Total	2,419,512	988,980	742,462	400,281	172,374	67,573	26,033	10,785	5,533	2,912	1,226	790	520	40	3
HARDWOODS:															
Select white oak	143,370	52,290	36,765	21,166	12,861	8,700	5,175	2,985	1,720	773	464	224	217	28	2
Select red oak	101,004	18,342	15,403	20,244	18,178	12,200	7,073	4,394	2,454	1,357	652	365	301	40	1
Other red oak	1,401	378	138	211	155	121	88	90	95	55	27	17	25	1	--
Hickory	12,389	7,906	1,656	1,419	637	408	205	101	36	12	7	2	--	--	--
Yellow birch	5,049	2,701	1,274	380	199	97	178	93	49	41	18	8	11	--	--
Hard maple	209,611	119,713	55,223	19,283	7,136	3,817	1,863	1,294	683	380	123	44	50	1	1
Soft maple	197,182	102,676	60,337	23,016	6,880	2,128	1,049	503	255	142	68	36	64	21	7
Ash	454,660	239,421	106,381	58,094	28,265	13,535	5,121	2,342	976	308	118	51	41	5	2
Balsam poplar	255,451	119,489	53,996	33,750	23,626	13,623	6,818	2,673	1,046	297	94	14	24	1	--
Paper birch	587,564	181,470	170,463	121,950	70,416	29,257	9,875	2,858	900	223	127	16	9	--	--
Bigtooth aspen	35,478	8,155	5,711	6,418	7,110	4,780	2,100	777	287	108	22	10	--	--	--
Quaking aspen	1,381,842	684,732	247,085	171,847	137,913	82,576	38,233	13,500	4,233	1,226	339	101	57	--	--
Basswood	132,430	48,592	28,041	21,631	15,285	8,831	4,769	2,425	1,388	747	389	171	143	17	1
Elm	155,692	68,085	34,889	20,324	12,934	7,625	4,415	2,616	1,887	1,217	617	414	530	121	18
Select hardwoods	16,662	10,904	2,466	1,483	699	510	286	126	123	48	8	4	5		--
Other hardwoods	33,576	16,654	8,112	3,598	2,148	1,403	688	364	221	138	84	66	44	39	17
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	3,723,361	1,681,508	827,940	524,814	344,442	189,611	87,936	37,141	16,353	7,072	3,157	1,543	1,521	274	49
All species	6,142,873	2,670,488	1,570,402	925,095	516,816	257,184	113,969	47,926	21,886	9,984	4,383	2,333	2,041	314	52

Table 24.--Number of growing-stock trees on commercial forest land by species group and Forest Survey Unit, Minnesota, 1977

(In thousand trees)

Species	All units	Aspen-Birch	Northern Pine	Central Hardwood	Prairie
SOFTWOODS:					
White pine	26,402	12,368	11,705	2,329	--
Red pine	69,662	31,991	29,529	8,123	19
Jack pine	157,327	35,364	116,948	4,972	43
White spruce	58,356	36,230	21,289	798	39
Black spruce	736,707	550,365	177,347	8,811	184
Balsam fir	932,749	668,902	258,386	5,269	192
Tamarack	199,915	84,419	105,253	10,065	178
Northern white-cedar	232,128	154,502	77,626	--	--
Other softwoods	6,266	315	106	4,484	1,361
Total	2,419,512	1,574,456	798,189	44,851	2,016
HARDWOODS:					
Select white oak	143,370	2,529	89,517	36,550	14,774
Select red oak	101,004	1,855	57,252	39,823	2,074
Other red oak	1,401	--	718	638	45
Hickory	12,389	--	198	12,111	80
Yellow birch	5,049	1,819	2,133	1,097	--
Hard maple	209,611	65,281	105,767	36,150	2,413
Soft maple	197,182	85,414	71,241	40,251	276
Ash	454,660	191,103	201,976	50,525	11,056
Balsam poplar	255,451	97,790	135,790	3,916	17,955
Paper birch	587,564	328,755	204,134	53,304	1,371
Bigtooth aspen	35,478	4,433	25,339	5,692	14
Quaking aspen	1,381,842	584,299	602,327	110,801	84,415
Basswood	132,430	9,063	74,343	44,692	4,332
Elm	155,692	12,720	69,716	58,588	14,668
Select hardwoods	16,662	312	3,140	10,271	2,939
Other hardwoods	33,576	1,130	3,457	13,667	15,322
Noncommercial species	--	--	--	--	--
Total	3,723,361	1,386,503	1,647,048	518,076	171,734
All species	6,142,873	2,960,959	2,445,237	562,927	173,750

Table 25.--Number of short-log trees on commercial forest land by species group and diameter class, Minnesota, 1977

(In thousand trees)

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:											
White pine	93	37	8	17	20	3	2	--	5	1	--
Red pine	63	31	18	9	--	3	2	--	--	--	--
Jack pine	417	239	115	49	11	3	--	--	--	--	--
White spruce	35	26	5	--	4	--	--	--	--	--	--
Black spruce	142	130	8	--	4	--	--	--	--	--	--
Balsam fir	427	342	49	10	12	14	--	--	--	--	--
Tamarack	268	175	81	6	3	3	--	--	--	--	--
Northern white-cedar	1,880	883	613	210	70	84	14	4	2	--	--
Other softwoods	59	52	--	--	4	--	3	--	--	--	--
Total	3,384	1,915	897	301	128	110	21	4	7	1	--
HARDWOODS:											
Select white oak	1,133	--	492	208	215	89	51	42	29	7	--
Select red oak	864	--	323	266	121	76	26	31	19	2	--
Other red oak	25	--	5	12	--	3	3	2	--	--	--
Hickory	17	--	5	10	--	--	2	--	--	--	--
Yellow birch	90	--	18	42	5	10	--	2	13	--	--
Hard maple	547	--	174	184	96	29	33	6	24	1	--
Soft maple	160	--	27	58	30	15	13	4	7	5	1
Ash	347	--	217	75	39	9	2	2	2	1	--
Balsam poplar	455	--	211	76	16	103	26	19	3	--	1
Paper birch	1,398	--	595	278	307	131	35	8	44	--	--
Bigtooth aspen	184	--	85	57	19	23	--	--	--	--	--
Quaking aspen	3,909	--	2,131	939	497	222	99	10	10	1	--
Basswood	384	--	175	86	54	22	14	7	24	2	--
Elm	1,099	--	510	212	153	84	54	33	38	12	3
Select hardwoods	49	--	7	5	24	10	--	2	1	--	--
Other hardwoods	310	--	161	88	31	14	5	2	6	1	2
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--
Total	10,971	--	5,136	2,596	1,607	840	363	170	220	32	7
All species	14,355	1,915	6,033	2,897	1,735	950	384	174	227	33	7

Table 26.--Net volume of growing stock and sawtimber on commercial forest land by species group, Minnesota, [1/]1962 and 1977

Species	Growing stock		Sawtimber	
	[1/]1962	1977	[1/]1962	1977
	Thousand cubic feet		[2/]Thousand board feet	
SOFTWOODS:				
White pine	191,796	194,797	900,060	1,068,372
Red pine	325,301	434,556	1,530,249	1,952,896
Jack pine	733,320	593,704	1,402,842	1,566,444
Spruce	813,347	717,920	849,704	1,109,131
Balsam fir	765,270	893,608	791,442	1,338,249
Tamarack	302,558	250,589	281,500	346,508
Northern white-cedar	251,867	387,215	376,843	1,142,761
Other softwoods	--	4,618	--	6,228
Total	3,383,459	3,477,007	6,132,640	8,530,589
HARDWOODS:				
White oak	278,877	358,272	817,696	1,076,044
Red oak	433,424	581,563	1,027,215	1,820,036
Yellow birch	13,904	10,611	63,839	39,926
Hard maple	134,865	189,024	455,532	489,619
Soft maple	94,429	131,845	232,890	281,999
Ash	426,107	538,086	758,002	993,952
Paper birch	841,822	1,273,982	491,034	1,234,388
Aspen	2,790,752	3,410,720	2,208,044	5,974,671
Basswood	239,667	402,424	719,073	1,116,835
Elm	341,740	431,437	1,257,911	1,607,307
Other hardwoods	464,614	649,026	710,952	1,441,832
Total	6,060,201	7,976,990	8,742,188	16,076,609
All species	9,443,660	11,453,997	14,874,828	24,607,198

[1/]Figures have been adjusted from those published after the 1962 survey to conform to 1977 volumes because of changes in survey definitions and procedures.

[2/]International 1/4-inch rule.

Table 27.--Cubic foot volume in all live trees on commercial forest land by species group and diameter class, Minnesota, 1977

(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:													
White pine	205,023	7,642	9,141	22,103	15,544	22,314	28,626	29,505	16,398	16,236	30,644	6,552	318
Red pine	437,926	25,560	50,642	56,305	56,198	60,473	64,893	58,162	30,079	25,080	10,207	327	--
Jack pine	619,448	100,012	173,666	157,527	113,540	46,410	22,888	3,727	1,112	396	170	--	--
White spruce	183,887	24,023	25,736	30,613	31,104	24,622	21,153	12,044	8,332	3,956	2,304	--	--
Black spruce	552,013	266,807	171,833	78,841	21,044	8,904	2,778	1,069	685	52	--	--	--
Balsam fir	937,200	323,402	296,481	186,037	86,750	29,843	9,451	4,672	322	242	--	--	--
Tamarack	277,608	107,291	88,212	47,286	24,004	7,410	2,402	812	96	--	95	--	--
Northern white-cedar	463,876	84,543	106,085	99,802	74,301	47,050	26,702	13,924	7,513	2,136	1,713	107	--
Other softwoods	5,945	2,051	1,534	846	657	361	201	63	158	74	--	--	--
Total	3,682,926	941,331	923,330	679,360	423,142	247,387	179,094	123,978	64,695	48,172	45,133	6,986	318
HARDWOODS:													
Select white oak	414,782	44,857	58,800	67,455	65,416	52,418	44,138	26,149	19,917	12,956	18,498	3,788	390
Select red oak	628,225	51,581	94,520	108,368	97,333	85,856	64,822	46,732	29,555	20,466	23,471	5,286	235
Other red oak	13,844	453	702	1,074	1,232	1,743	2,453	1,876	1,406	1,185	1,653	67	--
Hickory	17,210	3,191	3,246	3,674	2,824	2,307	1,028	420	397	123	--	--	--
Yellow birch	18,196	1,335	1,710	1,704	3,227	2,803	1,791	1,874	893	947	1,855	57	--
Hard maple	263,723	50,307	42,078	46,499	33,412	34,086	23,707	16,377	8,428	3,638	4,831	295	65
Soft maple	171,993	47,787	37,694	22,744	16,254	11,814	9,513	6,730	4,119	2,663	5,690	4,100	2,885
Ash	585,894	135,853	145,970	127,276	77,422	48,013	28,294	10,222	5,767	2,667	3,542	574	294
Balsam poplar	598,970	88,420	141,475	141,920	110,400	63,090	32,721	13,196	4,533	1,344	1,662	172	37
Paper birch	1,416,500	362,655	446,212	320,088	166,257	70,803	31,720	10,298	6,306	1,477	684	--	--
Bigtooth aspen	201,225	20,348	48,333	54,754	37,974	21,471	10,378	5,299	1,771	853	44	--	--
Quaking aspen	3,782,905	540,038	934,303	974,591	709,965	360,902	160,098	65,698	24,249	8,332	4,704	25	--
Basswood	442,931	49,939	80,985	80,692	69,324	51,440	39,635	27,161	18,229	10,168	12,325	2,703	330
Elm	485,879	37,657	53,695	61,411	58,300	52,447	50,973	44,231	29,745	25,012	44,323	21,562	6,523
Select hardwoods	22,911	4,006	3,310	4,002	3,665	2,512	2,501	1,419	412	216	556	312	--
Other hardwoods	80,832	8,255	10,115	10,718	9,590	7,480	6,249	4,935	3,921	4,136	4,540	5,872	5,021
Noncommercial species	16,884	7,794	4,774	1,783	1,046	557	436	135	197	--	65	97	--
Total	9,162,904	1,454,476	2,107,922	2,028,753	1,463,641	869,742	510,457	282,752	159,845	96,183	128,443	44,910	15,780
All species	12,845,830	2,395,807	3,031,252	2,708,113	1,886,783	1,117,129	689,551	406,730	224,540	144,355	173,576	51,896	16,098

Table 28.--Net volume of timber on commercial forest land by class of timber and softwoods and hardwoods, Minnesota, 1977

(In thousand cubic feet)

Class of timber	All species	Softwoods	Hardwoods
GROWING-STOCK TREES:			
Saw log trees			
Saw log portion	3,499,363	1,292,396	2,206,967
Upper stem portion	1,232,785	426,209	806,576
Subtotal	4,732,148	1,718,605	3,013,543
Poletimber	6,721,849	1,758,402	4,963,447
Total	11,453,997	3,477,007	7,976,990
CULL TREES:			
Rough and rotten cull trees			
Sawtimber	473,416	72,602	400,814
Poletimber	733,960	106,257	627,703
Subtotal	1,207,376	178,859	1,028,517
Short-log cull trees			
Sawtimber	184,457	27,060	157,397
Poletimber	--	--	--
Subtotal	184,457	27,060	157,397
Total	1,391,833	205,919	1,185,914
SALVABLE DEAD TREES:	107,031	47,856	59,175
All classes	12,952,861	3,730,782	9,222,079

Table 29.--Net volume of growing stock and sawtimber on commercial forest land by county and species category, Minnesota, 1977

ASPEN-BIRCH

County	Growing stock						Sawtimber					
	All species	Pine	Spruce-fir	Other softwoods	Aspen	Other hardwoods	All species	Pine	Spruce-fir	Other softwoods	Aspen	Other hardwoods
	-Thousand cubic feet-						-Thousand board feet[1]-					
Carlton	210,376	18,849	25,747	8,117	57,322	100,341	347,958	91,996	37,529	10,104	62,312	146,017
Cook	534,017	33,526	179,850	31,744	171,395	117,502	1,083,698	136,545	313,513	116,398	400,505	116,737
Koochiching	928,923	43,462	271,210	135,430	262,888	215,933	1,594,444	145,029	308,582	330,176	387,920	422,737
Lake	694,029	59,566	165,030	54,112	158,441	256,880	1,466,852	253,984	246,627	199,397	366,035	400,809
St. Louis	2,154,730	295,927	474,006	92,359	736,692	555,746	3,831,644	1,074,438	677,313	199,597	1,187,494	692,802
Total	4,522,075	451,330	1,115,843	321,762	1,386,738	1,246,402	8,324,596	1,701,992	1,583,564	855,672	2,404,266	1,779,102
NORTHERN PINE												
Aitkin	487,614	8,372	36,300	34,082	123,423	285,437	1,039,872	38,096	63,867	60,083	251,714	626,112
Becker	305,068	33,278	14,819	7,191	107,449	142,331	620,361	108,439	35,053	15,581	153,771	307,517
Beltrami	683,735	105,002	67,283	71,526	213,220	226,704	1,407,730	402,218	102,768	98,078	387,647	417,019
Cass	854,270	186,144	64,160	34,964	274,528	294,474	2,027,912	782,239	128,207	85,317	564,796	467,353
Clearwater	266,797	21,628	15,774	11,151	100,995	117,249	521,323	98,311	27,623	28,683	148,506	218,200
Crow Wing	327,167	58,342	5,903	5,501	109,000	148,421	592,708	163,761	7,621	10,789	195,735	214,802
Hubbard	344,524	89,758	13,271	5,252	147,637	88,606	608,538	270,562	31,813	12,934	199,544	93,685
Itasca	1,297,155	157,615	225,932	77,632	426,676	409,300	2,987,983	703,993	395,196	202,778	942,958	743,058
Lake of the Woods	192,801	27,116	29,604	28,461	58,679	48,941	334,578	66,212	32,034	44,231	98,880	93,221
Mahnomen	91,371	1,495	589	1,067	29,118	59,102	168,247	2,764	1,730	3,829	47,271	112,653
Roseau	99,416	16,466	9,369	13,351	29,068	31,162	183,368	53,389	15,509	22,931	43,336	48,203
Wadena	72,976	28,992	881	1,183	22,466	19,454	128,130	62,728	2,838	--	22,387	40,177
Total	5,022,894	734,208	483,885	291,361	1,642,259	1,871,181	10,620,750	2,752,712	844,259	585,234	3,056,545	3,382,000

(Table 29 continued on next page)

(Table 29 continued)

CENTRAL HARDWOOD

County	Growing stock						Sawtimber					
	All species	Pine	Spruce-fir	Other softwoods	Aspen	Other hardwoods	All species	Pine	Spruce-fir	Other softwoods	Aspen	Other hardwoods
	-Thousand cubic feet-						-Thousand board feet[1/]-					
Anoka	28,414	821	52	747	2,202	24,592	105,665	2,481	97	1,565	3,605	97,917
Benton	22,075	1,271	61	145	2,758	17,840	73,720	2,356	140	382	4,949	65,893
Carver	9,221	111	9	154	487	8,460	38,303	548	19	326	846	36,564
Chisago	39,317	1,511	238	1,364	3,960	32,244	136,656	3,134	411	2,800	6,908	123,403
Dakota	13,381	285	65	606	1,367	11,058	45,496	1,125	119	1,060	2,465	40,727
Douglas	12,281	235	65	321	2,208	9,452	35,423	990	168	762	3,094	30,409
Fillmore	54,832	1,219	19	354	5,949	47,291	183,563	5,213	73	696	8,751	168,830
Goodhue	52,365	805	40	397	4,440	46,683	182,049	2,902	94	723	7,397	170,933
Hennepin	6,455	76	12	168	394	5,805	26,870	346	22	335	768	25,399
Houston	106,619	801	32	273	6,244	99,269	392,741	3,560	111	493	10,500	378,077
Isanti	32,797	2,251	283	1,713	3,942	24,608	97,605	3,595	410	3,703	5,974	83,923
Kanabec	101,060	1,857	678	2,204	26,220	70,101	255,196	8,055	1,074	4,898	40,544	200,625
Le Sueur	9,030	89	20	270	520	8,131	36,716	365	36	537	978	34,800
Mille Lacs	95,532	1,542	674	2,179	22,976	68,161	247,242	6,523	1,080	4,664	37,573	197,402
Morrison	115,167	3,027	271	2,372	14,803	94,694	366,219	10,483	496	5,165	22,511	327,564
Olmsted	26,266	596	8	221	2,572	22,869	91,348	2,685	30	462	3,781	84,390
Otter Tail	140,234	3,191	1,217	2,974	35,703	97,149	345,069	12,702	2,084	5,992	56,778	267,513
Pine	299,170	11,035	6,434	7,574	107,800	166,327	588,231	38,601	9,162	10,393	162,088	367,987
Ramsey	--	--	--	--	--	--	--	--	--	--	--	--
Rice	10,778	83	33	148	820	9,694	44,855	391	100	332	1,448	42,584
Scott	12,340	123	16	234	589	11,378	51,873	581	39	491	1,065	49,697
Sherburne	48,087	1,586	268	543	3,543	42,147	167,266	3,911	265	454	5,591	157,045
Stearns	49,181	723	77	349	4,286	43,746	178,922	3,413	177	706	8,040	166,586
Todd	77,260	1,154	421	1,416	14,058	60,211	222,937	4,840	1,111	3,155	22,988	190,843
Wabasha	48,661	900	31	506	5,049	42,175	162,174	3,807	87	1,012	7,774	149,494
Washington	8,726	96	40	336	779	7,475	34,426	394	43	557	1,374	32,058
Winona	100,794	908	24	231	6,915	92,716	360,560	3,885	85	394	11,370	344,826
Wright	26,773	439	85	362	3,913	21,974	82,629	1,855	230	828	6,222	73,494
Total	1,546,816	36,735	11,173	28,161	284,497	1,186,250	4,553,754	128,741	17,763	52,885	445,382	3,908,983

(Table 29 continued on next page)

(Table 29 continued)

PRAIRIE

County	Growing stock						Sawtimber					
	All species	Pine	Spruce-fir	Other softwoods	Aspen	Other hardwoods	All species	Pine	Spruce-fir	Other softwoods	Aspen	Other hardwoods
	Thousand cubic feet						Thousand board feet[1/]					
Big Stone	1,574	--	--	2	282	1,290	5,317	--	--	5	225	5,087
Blue Earth	19,767	--	2	93	983	18,689	88,482	--	8	135	844	87,495
Brown	8,526	--	--	66	469	7,991	37,925	--	--	96	465	37,364
Chippewa	2,438	--	--	5	487	1,946	7,575	--	--	10	415	7,150
Clay	7,296	--	12	8	1,435	5,841	23,101	--	68	16	835	22,182
Cottonwood	2,153	--	--	--	382	1,771	7,863	--	--	--	363	7,500
Dodge	6,136	--	--	69	162	5,905	28,198	--	--	100	136	27,962
Faribault	5,608	--	--	6	446	5,156	24,300	--	--	9	430	23,861
Freeborn	4,339	--	2	43	221	4,073	19,191	--	8	64	134	18,985
Grant	2,715	--	--	1	461	2,253	9,536	--	--	2	249	9,285
Jackson	1,958	--	--	3	207	1,748	7,902	--	--	4	180	7,718
Kandiyohi	7,947	--	3	57	709	7,178	33,130	--	17	85	592	32,436
Kittson	32,021	296	114	106	16,958	14,547	44,047	1,614	137	194	10,077	32,025
Lac qui Parle	3,580	--	1	2	480	3,097	14,047	--	9	3	468	13,567
Lincoln	1,867	--	--	9	230	1,628	7,511	--	--	13	203	7,295
Lyon	3,485	--	--	10	359	3,116	14,137	--	--	15	325	13,797
McLeod	5,839	--	--	1	310	5,528	26,304	--	--	1	210	26,093
Marshall	63,118	371	283	207	29,098	33,159	111,282	2,021	687	293	18,437	89,844
Martin	3,085	--	--	1	521	2,563	11,394	--	--	1	468	10,925
Meeker	9,998	--	--	31	208	9,759	47,438	--	--	44	173	47,221
Mower	4,959	--	--	46	204	4,709	22,417	--	--	66	175	22,176
Murray	790	--	--	--	72	718	3,197	--	--	1	61	3,135
Nicollet	11,490	--	1	20	601	10,868	52,093	--	8	28	575	51,482
Nobles	523	--	--	--	135	388	1,553	--	--	1	115	1,437
Norman	15,448	11	19	11	5,353	10,054	39,652	61	86	19	4,235	35,251
Pennington	20,227	37	41	20	8,665	11,464	43,803	199	165	35	6,607	36,797
Pipestone	382	--	--	3	69	310	1,338	--	--	4	59	1,275
Polk	48,740	38	99	69	14,344	34,190	144,142	208	452	107	10,790	132,585
Pope	4,762	2	10	31	1,120	3,599	14,027	8	6	36	905	13,072
Red Lake	17,932	29	29	34	8,048	9,792	36,804	156	110	55	6,257	30,226
Redwood	4,783	--	3	31	668	4,081	17,862	--	17	45	547	17,253
Renville	6,586	--	6	37	584	5,959	27,371	--	8	48	543	26,772
Rock	319	--	--	1	49	269	1,054	--	--	1	42	1,011
Sibley	10,382	--	--	51	562	9,769	46,617	--	--	73	437	46,107
Steele	4,560	--	2	24	283	4,251	20,074	--	8	35	202	19,829
Stevens	741	--	--	--	184	557	2,389	--	--	1	120	2,268
Swift	3,494	--	--	7	639	2,848	12,142	--	--	10	493	11,639
Traverse	509	--	--	2	107	400	1,477	--	--	3	91	1,383
Waseca	4,007	--	--	10	166	3,831	18,469	--	--	15	156	18,298
Watonwan	897	--	--	--	19	878	4,240	--	--	--	52	4,188
Wilkin	225	--	--	1	65	159	537	--	--	1	32	504
Yellow Medicine	7,006	--	--	20	881	6,105	28,157	--	--	30	754	27,373
Total	362,212	784	627	1,138	97,226	262,437	1,108,095	4,267	1,794	1,704	68,477	1,031,853
All units	11,453,997	1,223,057	1,611,528	642,422	3,410,720	4,566,270	24,607,195	4,587,712	2,447,380	1,495,495	5,974,670	10,101,938

1/International 1/4-inch rule.

Table 30.--Net volume of growing stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species, Minnesota, 1977

Species	Total all live	Growing stock	Short-log	Rough and rotten	Sawtimber
	- - - - - - - -Thousand cubic feet- - - - - - - -				Thousand board feet[1/]
SOFTWOODS:					
White pine	205,023	194,797	1,729	8,497	1,068,372
Red pine	437,926	434,556	785	2,585	1,952,896
Jack pine	619,449	593,704	4,109	21,636	1,566,444
Scotch pine	1,165	1,036	--	129	1,666
White spruce	183,887	180,969	264	2,654	648,730
Black spruce	552,013	536,951	1,208	13,854	460,401
Balsam fir	937,200	893,608	4,229	39,363	1,338,249
Tamarack	277,608	250,589	2,462	24,557	346,508
Northern white-cedar	463,876	387,215	11,883	64,778	1,142,761
Eastern redcedar	4,779	3,582	391	806	4,562
Total	3,682,926	3,477,007	27,060	178,859	8,530,589
HARDWOODS:					
White oak	65,467	54,086	3,761	7,620	204,223
Burr oak	349,191	304,186	12,310	32,695	871,821
Swamp white oak	124	--	--	124	--
Northern red oak	628,225	568,939	13,346	45,940	1,763,622
Black oak	2,734	2,372	--	362	10,525
Northern pin oak	11,110	10,252	385	473	45,889
Bitternut hickory	5,294	5,211	--	83	6,798
Shagbark hickory	11,916	11,207	200	509	25,585
Yellow birch	18,196	10,611	2,057	5,528	39,926
Sugar maple	262,890	188,534	10,015	64,341	487,955
Black maple	833	490	--	343	1,664
Red maple	134,415	100,171	1,519	32,725	110,402
Silver maple	37,578	31,674	1,869	4,035	171,596
White ash	2,809	2,349	--	460	10,239
Black ash	485,614	449,732	4,003	31,879	727,731
Green ash	97,471	86,005	1,364	10,102	255,982
Balsam poplar	598,970	548,624	5,239	45,107	1,101,406
Paper birch	1,416,500	1,273,982	11,929	130,589	1,234,388
Bigtooth aspen	201,225	174,315	3,398	23,512	303,391
Quaking aspen	3,782,905	3,236,405	60,256	486,244	5,671,280
Basswood	442,931	402,424	7,295	33,212	1,116,835
American elm	449,804	398,468	14,725	36,611	1,461,780
Slippery elm	31,155	28,681	465	2,009	129,165
Rock elm	4,920	4,288	104	528	16,362
Butternut	7,659	5,575	354	1,730	13,357
Black walnut	5,071	4,686	124	261	13,690
Black cherry	10,181	8,055	11	2,115	13,145
Boxelder	33,332	22,203	1,133	9,996	53,725
River birch	504	300	73	131	289
Hackberry	4,142	3,585	242	315	14,923
Eastern cottonwood	23,205	21,589	887	729	117,565
Black willow	19,076	17,561	257	1,258	80,118
Kentucky coffeetree	573	430	76	67	1,231
Noncommercial	16,884	--	--	16,884	--
Total	9,162,904	7,976,990	157,397	1,028,517	16,076,608
All species	12,845,830	11,453,997	184,457	1,207,376	24,607,197

[1/]International 1/4-inch rule.

Table 31.--Net volume of growing stock on commercial forest land by species group and Forest Survey Unit, Minnesota, 1977

(In thousand cubic feet)

Species	All units	Aspen-Birch	Northern Pine	Central Hardwood	Prairie
SOFTWOODS:					
White pine	194,797	91,561	90,495	12,741	--
Red pine	434,556	147,197	273,024	13,843	492
Jack pine	593,704	212,572	370,689	10,151	292
White spruce	180,969	136,485	42,389	1,705	390
Black spruce	536,951	419,971	113,362	3,555	63
Balsam fir	893,608	559,387	328,134	5,913	174
Tamarack	250,589	75,063	150,313	24,900	313
Northern white-cedar	387,215	246,561	140,654	--	--
Other softwoods	4,618	138	394	3,261	825
Total	3,477,007	1,888,935	1,509,454	76,069	2,549
HARDWOODS:					
Select white oak	358,272	5,277	119,986	172,960	60,049
Select red oak	568,939	9,347	217,524	326,516	15,552
Other red oak	12,624	--	1,015	11,087	522
Hickory	16,418	--	520	15,522	376
Yellow birch	10,611	6,861	3,552	198	--
Hard maple	189,024	43,352	83,680	54,508	7,484
Soft maple	131,845	38,495	49,757	40,258	3,335
Ash	538,086	196,644	241,200	76,509	23,733
Balsam poplar	548,624	244,477	265,529	12,839	25,779
Paper birch	1,273,982	620,775	538,764	111,395	3,048
Bigtooth aspen	174,315	21,001	123,016	30,271	27
Quaking aspen	3,236,405	1,365,737	1,519,243	254,226	97,199
Basswood	402,424	35,262	203,813	133,839	29,510
Elm	431,437	45,431	141,808	185,338	58,860
Select hardwoods	18,316	53	2,005	14,303	1,955
Other hardwoods	65,668	428	2,028	30,978	32,234
Noncommercial species	--	--	--	--	--
Total	7,976,990	2,633,140	3,513,440	1,470,747	359,663
All species	11,453,997	4,522,075	5,022,894	1,546,816	362,212

Table 32.--Net volume of sawtimber on commercial forest land by species group and Forest Survey Unit, Minnesota, 1977

(In thousand board feet)[1/]

Species	All units	Aspen-Birch	Northern Pine	Central Hardwood	Prairie
SOFTWOODS:					
White pine	1,068,372	515,487	489,804	63,081	--
Red pine	1,952,896	596,918	1,310,295	42,516	3,167
Jack pine	1,566,444	589,587	952,613	23,144	1,100
White spruce	648,730	471,316	168,448	7,172	1,794
Black spruce	460,401	371,239	87,515	1,647	--
Balsam fir	1,338,249	741,009	588,296	8,944	--
Tamarack	346,508	86,831	210,950	48,280	447
Northern white-cedar	1,142,761	768,841	373,920	--	--
Other softwoods	6,228	--	364	4,605	1,259
Total	8,530,589	4,141,228	4,182,205	199,389	7,767
HARDWOODS:					
Select white oak	1,076,044	13,774	264,498	570,892	226,880
Select red oak	1,763,622	23,285	439,583	1,237,647	63,107
Other red oak	56,414	--	1,141	52,870	2,403
Hickory	32,383	--	444	31,088	851
Yellow birch	39,926	27,091	11,866	969	--
Hard maple	489,619	56,909	204,393	198,945	29,372
Soft maple	281,998	30,931	75,450	158,376	17,241
Ash	993,952	312,399	352,993	227,791	100,769
Balsam poplar	1,101,406	481,135	572,553	18,664	29,054
Paper birch	1,234,388	591,221	570,799	69,492	2,876
Bigtooth aspen	303,391	32,683	213,453	57,255	--
Quaking aspen	5,671,280	2,371,583	2,843,092	388,128	68,477
Basswood	1,116,835	64,530	413,860	489,971	148,474
Elm	1,607,307	176,959	468,485	691,004	270,859
Select hardwoods	40,192	--	2,223	32,630	5,339
Other hardwoods	267,851	868	3,712	128,643	134,628
Noncommercial species	--	--	--	--	--
Total	16,076,608	4,183,368	6,438,545	4,354,365	1,100,330
All species	24,607,197	8,324,596	10,620,750	4,553,754	1,108,097

[1/]International 1/4-inch rule.

Table 33.--Net volume of growing stock on commercial forest land by species group and diameter class, Minnesota, 1977

(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:													
White pine	194,797	6,149	7,815	20,429	14,865	21,769	26,433	29,044	16,165	15,782	29,836	6,192	318
Red pine	434,556	24,844	49,880	55,803	55,778	60,043	64,893	57,934	29,903	25,005	10,158	315	--
Jack pine	593,704	95,316	166,977	151,777	109,695	43,944	21,196	3,499	734	396	170	--	--
White spruce	180,969	23,613	24,773	29,975	30,605	24,510	21,072	11,881	8,281	3,955	2,304	--	--
Black spruce	536,951	258,093	168,191	76,734	20,653	8,862	2,612	1,069	685	52	--	--	--
Balsam fir	893,608	305,998	285,790	177,026	83,296	28,282	8,862	3,789	323	242	--	--	--
Tamarack	250,589	95,661	80,677	42,818	21,901	6,692	2,150	595	--	--	95	--	--
Northern white-cedar	387,215	70,403	90,957	82,057	60,214	39,889	22,618	11,559	6,307	1,658	1,462	91	--
Other softwoods	4,618	1,751	1,515	559	591	132	70	--	--	--	--	--	--
Total	3,477,007	881,828	876,575	637,178	397,598	234,123	169,906	119,370	62,398	47,090	44,025	6,598	318
HARDWOODS:													
Select white oak	358,272	40,856	53,466	61,660	56,973	46,495	36,325	21,257	16,177	9,728	12,586	2,359	390
Select red oak	568,939	46,756	88,659	101,481	88,002	77,602	57,935	41,582	25,635	17,550	19,538	4,012	187
Other red oak	12,624	404	676	1,005	1,189	1,453	2,453	1,737	1,185	826	1,628	68	--
Hickory	16,418	3,090	3,191	3,592	2,713	2,077	918	384	330	123		--	--
Yellow birch	10,611	874	951	732	2,119	1,623	1,187	1,262	774	450	639	--	--
Hard maple	189,024	41,911	32,145	30,538	23,155	23,212	16,150	11,876	4,794	1,952	3,166	60	65
Soft maple	131,845	40,366	27,996	16,470	12,622	9,181	6,509	4,818	2,845	1,920	4,449	2,694	1,975
Ash	538,086	125,386	135,624	116,819	70,105	44,109	25,857	9,037	5,336	2,275	2,806	438	294
Balsam poplar	548,624	79,004	129,510	131,819	103,339	57,647	29,877	11,009	3,930	863	1,454	172	--
Paper birch	1,273,982	325,598	406,838	291,766	147,840	61,949	25,675	7,906	5,092	901	417	--	--
Bigtooth aspen	174,315	17,677	43,195	49,705	32,880	17,052	8,190	4,056	1,009	551	--	--	--
Quaking aspen	3,236,405	470,750	820,817	854,070	607,753	294,792	121,463	43,802	14,986	4,900	3,072	--	--
Basswood	402,424	44,906	75,355	74,498	62,992	46,707	35,977	24,444	16,578	8,772	9,931	2,078	186
Elm	431,437	35,234	49,769	54,498	52,357	46,789	46,464	40,376	26,398	21,716	37,658	15,916	4,262
Select hardwoods	18,316	2,936	2,699	3,480	3,079	1,954	2,215	1,213	287	169	284	--	--
Other hardwoods	65,668	6,856	8,450	9,368	7,664	5,799	4,916	3,985	3,212	3,080	3,215	4,883	4,240
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	7,976,990	1,282,604	1,879,341	1,801,501	1,274,782	738,441	422,111	228,744	128,568	75,776	100,843	32,680	11,599
All species	11,453,997	2,164,432	2,755,916	2,438,679	1,672,380	972,564	592,017	348,114	190,966	122,866	144,868	39,278	11,917

Table 34.--Net volume of sawtimber on commercial forest land by species group and diameter class, Minnesota, 1977

(In thousand board feet)[1/]

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:											
White pine	1,068,372	121,360	93,477	130,950	153,745	167,250	94,677	91,464	175,759	37,359	2,331
Red pine	1,952,896	261,711	288,634	312,921	346,863	329,144	178,336	160,738	71,378	3,171	--
Jack pine	1,566,444	725,404	506,640	205,290	106,429	16,547	3,364	1,991	779	--	--
White spruce	648,730	126,383	140,116	124,198	110,760	64,162	47,201	22,178	13,732	--	--
Black spruce	460,401	307,934	89,418	40,786	12,564	5,568	3,539	592	--	--	--
Balsam fir	1,338,249	784,954	369,426	124,454	39,333	17,287	1,430	1,365	--	--	--
Tamarack	346,508	198,533	102,284	31,041	10,570	3,160	--	--	920	--	--
Northern white-cedar	1,142,761	421,477	301,268	197,974	110,762	57,344	34,045	9,943	9,091	857	--
Other softwoods	6,228	2,927	2,549	477	275	--	--	--	--	--	--
Total	8,530,589	2,950,683	1,893,812	1,168,091	891,301	660,462	362,592	288,271	271,659	41,387	2,331
HARDWOODS:											
Select white oak	1,076,044	--	301,831	247,911	194,992	111,213	86,100	52,070	67,403	12,488	2,036
Select red oak	1,763,622	--	455,970	412,745	311,706	223,639	137,318	94,558	105,549	21,036	1,101
Other red oak	56,414	--	6,441	7,692	12,915	9,459	6,387	4,386	8,729	405	--
Hickory	32,383	--	13,211	11,226	4,312	1,637	1,473	524	--	--	--
Yellow birch	39,926	--	10,374	8,443	6,651	6,202	3,717	1,958	2,581	--	--
Hard maple	489,619	--	134,596	132,811	92,012	70,081	29,254	11,626	18,315	470	454
Soft maple	281,998	--	73,576	59,117	40,986	30,231	18,306	11,982	25,173	13,747	8,880
Ash	993,952	--	440,293	271,984	152,502	58,515	33,079	15,803	17,839	2,432	1,505
Balsam poplar	1,101,406	--	534,789	307,661	161,412	60,691	21,563	4,900	9,653	737	--
Paper birch	1,234,388	--	742,689	305,074	121,115	38,016	21,772	4,017	1,705	--	--
Bigtooth aspen	303,391	--	154,814	81,851	39,560	19,260	4,866	3,040	--	--	--
Quaking aspen	5,671,280	--	3,179,633	1,518,668	631,756	221,601	77,557	25,103	16,962	--	--
Basswood	1,116,835	--	325,520	249,097	197,069	136,234	92,959	48,423	55,294	11,341	898
Elm	1,607,307	--	297,358	261,745	254,321	217,866	144,202	116,545	206,103	85,529	23,638
Select hardwoods	40,192	--	11,670	7,999	9,490	6,600	1,679	1,182	1,572	--	--
Other hardwoods	267,851	--	59,151	41,930	35,418	27,639	20,634	18,969	18,708	25,120	20,282
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--
Total	16,076,608	--	6,741,916	3,925,954	2,266,217	1,238,884	700,866	415,086	555,586	173,305	58,794
All species	24,607,197	2,950,683	8,635,728	5,094,045	3,157,518	1,899,346	1,063,458	703,357	827,245	214,692	61,125

[1/] International 1/4-inch rule.

Table 35.--Net volume of growing stock on commercial forest land by species group and forest type, Minnesota, 1977

(In thousand cubic feet)

Species	All types	Forest type						
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
SOFTWOODS:								
White pine	194,797	2,788	45,377	52,529	11,887	1,009	2,787	2,631
Red pine	434,556	38,735	251,343	16,619	12,406	1,119	1,839	3,477
Jack pine	593,704	435,520	16,837	5,630	6,558	2,506	15,145	1,862
White spruce	180,969	2,337	4,222	6,694	34,120	20,094	8,614	2,363
Black spruce	536,951	16,129	1,403	803	54,748	1,244	342,917	38,975
Balsam fir	893,608	5,764	14,921	3,850	299,047	4,765	29,742	33,255
Tamarack	250,589	125	281	--	11,015	624	37,677	11,725
Northern white-cedar	387,215	--	312	211	42,370	1,760	10,264	235,540
Other softwoods	4,618	--	589	--	--	--	184	--
Total	3,477,007	501,398	335,285	86,336	472,151	33,121	449,169	329,828
HARDWOODS:								
Select white oak	358,272	854	226	623	613	29	--	--
Select red oak	568,939	2,628	1,037	571	152	--	197	--
Other red oak	12,624	--	--	--	--	--	--	--
Hickory	16,418	--	--	--	--	--	--	--
Yellow birch	10,611	--	--	--	308	--	--	715
Hard maple	189,024	--	--	221	607	--	--	--
Soft maple	131,845	1,334	56	870	2,426	--	286	57
Ash	538,086	64	129	345	8,550	--	2,115	9,017
Balsam poplar	548,624	579	559	46	19,671	722	1,110	6,635
Paper birch	1,273,982	11,385	24,693	4,421	93,342	8,572	7,902	24,318
Bigtooth aspen	174,315	3,248	2,887	37	789	--	311	516
Quaking aspen	3,236,405	38,439	14,328	10,143	77,556	7,516	32,326	7,309
Basswood	402,424	63	--	465	1,448	--	--	--
Elm	431,437	124	43	--	1,530	--	79	172
Select hardwoods	18,316	--	--	--	--	--	--	--
Other hardwoods	65,668	225	118	--	--	--	--	--
Noncommercial species	--	--	--	--	--	--	--	--
Total	7,976,990	58,943	44,076	17,742	206,992	16,839	44,326	48,739
All species	11,453,997	560,341	379,361	104,078	679,143	49,960	493,495	378,567

(Table 35 continued on next page)

(Table 35 continued)

Species	Forest type							
	Tamarack	Oak hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
SOFTWOODS:								
White pine	1,248	2,422	1,583	12,990	43,050	14,053	443	--
Red pine	514	6,075	322	766	75,167	25,865	309	--
Jack pine	1,047	6,565	442	1,700	87,605	9,032	1,162	2,093
White spruce	488	554	5,123	7,715	65,257	17,996	5,392	--
Black spruce	21,379	86	2,265	975	48,382	4,671	2,537	437
Balsam fir	3,478	577	35,475	42,678	292,578	84,111	39,590	3,777
Tamarack	161,129	214	3,179	2,566	11,872	4,983	4,371	828
Northern white-cedar	4,706	--	29,393	12,048	31,292	12,495	6,419	405
Other softwoods	--	2,275	89	1,019	45	296	121	--
Total	193,989	18,768	77,871	82,457	655,248	173,502	60,344	7,540
HARDWOODS:								
Select white oak	--	186,573	7,989	64,565	85,978	8,692	1,924	206
Select red oak	197	345,887	1,118	66,373	120,485	29,402	892	--
Other red oak	--	9,034	317	1,774	1,296	69	134	--
Hickory	--	12,728	--	2,863	--	827	--	--
Yellow birch	--	--	1,814	6,110	250	1,185	229	--
Hard maple	--	5,497	1,901	147,695	23,019	8,550	1,430	104
Soft maple	253	5,064	28,823	34,196	40,287	17,832	361	--
Ash	424	9,393	267,189	95,747	98,957	24,632	20,901	623
Balsam poplar	2,308	1,949	21,942	16,858	231,042	23,691	221,373	139
Paper birch	3,135	44,595	28,129	81,071	448,945	467,891	24,200	1,383
Bigtooth aspen	--	11,001	1,233	9,597	135,755	8,588	353	--
Quaking aspen	2,604	53,146	22,274	85,594	2,697,885	124,144	59,467	3,674
Basswood	--	30,356	11,609	271,204	69,857	15,372	2,050	--
Elm	910	36,307	70,521	225,013	67,648	14,916	13,654	520
Select hardwoods	--	10,080	607	5,204	1,911	389	67	58
Other hardwoods	--	3,908	40,945	16,554	3,362	--	213	343
Noncommercial species	--	--	--	--	--	--		
Total	9,831	765,518	506,411	1,130,418	4,026,677	746,180	347,248	7,050
All species	203,820	784,286	584,282	1,212,875	4,681,925	919,682	407,592	14,590

Table 36.--Net volume of sawtimber on commercial forest land by species group and forest type, Minnesota, 1977

(In thousand board feet)[1/]

Species	All types	Forest type: Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
SOFTWOODS:								
White pine	1,068,372	10,856	237,978	289,021	72,837	6,649	16,097	16,202
Red pine	1,952,896	135,809	1,093,109	88,319	64,394	4,588	9,963	18,696
Jack pine	1,566,444	1,051,843	45,843	28,580	25,931	10,876	43,528	6,303
White spruce	648,730	4,381	13,789	29,458	125,019	65,686	26,213	8,914
Black spruce	460,401	11,469	998	1,192	79,000	1,404	180,844	64,052
Balsam fir	1,338,249	3,897	46,705	7,691	394,770	5,506	25,026	29,443
Tamarack	346,508	687	354	--	25,465	2,388	40,026	14,828
Northern white-cedar	1,142,761	--	1,101	428	132,944	7,411	17,620	619,635
Other softwoods	6,228	--	--	--	--	--	--	--
Total	8,530,589	1,218,942	1,439,877	444,689	920,360	104,508	359,317	778,073
HARDWOODS:								
Select white oak	1,076,044	393	--	552	1,904	--	--	--
Select red oak	1,763,622	1,531	2,005	2,376	438	--	--	--
Other red oak	56,414	--	--	--	--	--	--	--
Hickory	32,383	--	--	--	--	--	--	--
Yellow birch	39,926	--	--	--	646	--	--	2,236
Hard maple	489,619	--	--	1,344	--	--	--	--
Soft maple	281,998	--	--	346	7,623	--	684	--
Ash	993,952	--	--	368	12,125	--	6,719	16,218
Balsam poplar	1,101,406	975	--	--	30,680	750	1,048	16,036
Paper birch	1,234,388	3,909	36,621	3,857	141,043	11,322	4,826	42,718
Bigtooth aspen	303,391	1,181	318	--	2,475	--	393	1,176
Quaking aspen	5,671,280	61,514	19,307	37,026	123,947	16,488	31,878	15,719
Basswood	1,116,835	--	--	1,296	4,582	--	--	--
Elm	1,607,307	424	--	--	4,617	--	--	762
Select hardwoods	40,192	--	--	--	--	--	--	--
Other hardwoods	267,851	--	--	--	--	--	--	--
Noncommercial species	--	--	--	--	--	--	--	--
Total	16,076,608	69,927	58,251	47,165	330,080	28,560	45,548	94,865
All species	24,607,197	1,288,869	1,498,128	491,854	1,250,440	133,068	404,865	872,938

(Table 36 continued on next page)

[1/]International 1/4-inch rule.

(Table 36 continued)

Species	Forest type							
	Tamarack	Oak hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
SOFTWOODS:								
White pine	7,454	13,968	10,261	73,792	235,419	75,224	2,614	--
Red pine	2,293	27,070	1,128	4,353	365,963	135,609	1,602	--
Jack pine	2,655	18,743	1,214	7,218	284,213	32,953	896	5,648
White spruce	1,028	2,357	19,458	34,788	217,387	79,613	20,639	--
Black spruce	12,464	353	4,429	1,720	84,154	10,270	7,073	979
Balsam fir	4,453	493	59,563	94,096	459,104	125,661	71,838	10,003
Tamarack	177,555	1,101	7,247	6,685	36,068	14,748	17,602	1,754
Northern white-cedar	11,911	--	108,288	52,133	118,607	48,256	22,913	1,514
Other softwoods	--	4,039	364	1,825	--	--	--	--
Total	219,813	68,124	211,952	276,610	1,800,915	522,334	145,177	19,898
HARDWOODS:								
Select white oak	--	601,375	29,402	237,231	181,871	17,761	4,879	676
Select red oak	1,082	1,165,499	926	247,767	273,100	65,337	3,561	--
Other red oak	--	42,719	1,718	9,021	2,231	--	725	--
Hickory	--	23,625	--	5,456	--	3,302	--	--
Yellow birch	--	--	7,306	24,162	463	4,218	895	--
Hard maple	--	14,787	4,913	435,094	26,390	6,490	601	--
Soft maple	--	9,080	148,521	79,370	31,582	4,792	--	--
Ash	--	20,987	467,143	278,329	127,516	31,683	30,240	2,624
Balsam poplar	4,939	4,350	64,585	49,547	449,184	52,074	427,238	--
Paper birch	2,416	29,524	44,761	145,752	358,611	370,387	37,849	792
Bigtooth aspen	--	29,064	2,877	29,072	219,687	17,148	--	--
Quaking aspen	3,989	94,318	53,728	198,888	4,572,282	307,130	128,498	6,568
Basswood	--	78,306	40,612	860,089	98,727	29,965	3,258	--
Elm	811	122,620	270,664	936,185	182,843	39,943	46,278	2,160
Select hardwoods	--	21,447	226	15,359	2,483	677	--	--
Other hardwoods	--	12,123	177,158	68,153	8,492	--	--	1,925
Noncommercial species	--	--	--	--	--	--	--	--
Total	13,237	2,269,824	1,314,540	3,619,475	6,535,462	950,907	684,022	14,745
All species	233,050	2,337,948	1,526,492	3,896,085	8,336,377	1,473,241	829,199	34,643

Table 37.--Net volume of growing stock on commercial forest land by species group and ownership class, Minnesota, 1977

(In thousand cubic feet)

Species	All owners	Ownership class											
		National Forest	Bureau of Land Mgmt.	Indian	Misc. Federal	State	County & municipal	Forest Industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
SOFTWOODS:													
White pine	194,797	76,561	448	12,675	1,408	15,003	23,886	10,787	30,214	5,395	17,446	--	974
Red pine	434,556	185,006	2,503	18,320	958	47,939	62,798	20,305	48,232	6,782	41,713	--	--
Jack pine	593,704	157,912	9,613	8,978	4,146	101,261	89,280	46,130	96,742	13,088	66,288	266	--
White spruce	180,969	49,247	1,360	5,073	1,675	30,138	32,968	16,341	18,331	5,793	19,919	124	--
Black spruce	536,951	106,720	3,591	17,903	3,708	221,824	67,696	42,303	31,201	15,852	25,800	353	--
Balsam fir	893,608	218,902	913	22,874	5,106	156,371	201,918	77,640	94,053	35,962	79,551	--	318
Tamarack	250,589	13,094	571	17,729	1,483	108,065	36,308	6,387	42,774	7,531	16,647	--	--
Northern white-cedar	387,215	63,624	3,815	33,043	1,667	136,637	51,746	45,148	19,439	7,474	24,622	--	--
Other softwoods	4,618	--	--	--	--	983	138	--	2,568	604	325	--	--
Total	3,477,007	871,066	22,814	136,595	20,151	818,221	566,738	265,041	383,554	98,481	292,311	743	1,292
HARDWOODS:													
Select white oak	358,272	8,109	84	7,563	1,508	19,393	20,508	1,391	241,026	7,190	50,382	--	1,118
Select red oak	568,939	10,862	--	5,462	4,080	61,287	53,170	6,634	293,332	17,907	114,562	--	1,643
Other red oak	12,624	--	--	--	380	1,201	58	--	10,519	--	466	--	--
Hickory	16,418	--	--	191	327	246	300	--	14,067	--	1,287	--	--
Yellow birch	10,611	461	--	--	--	978	5,556	691	490	988	1,447	--	--
Hard maple	189,024	7,210	--	4,776	1,739	28,658	37,457	8,423	64,520	3,630	32,279	70	262
Soft maple	131,845	18,103	--	1,460	14,120	13,497	23,858	4,953	33,325	4,057	18,472	--	--
Ash	538,086	54,957	1,377	14,972	5,860	88,929	92,853	28,688	157,780	15,460	76,998	--	212
Balsam poplar	548,624	62,455	1,091	24,621	4,955	103,048	112,710	37,560	130,114	14,584	57,227	108	151
Paper birch	1,273,982	240,812	1,840	36,306	9,046	178,606	272,388	67,148	209,877	62,146	194,559	88	1,166
Bigtooth aspen	174,315	5,760	134	2,364	397	33,426	36,049	7,240	40,364	6,570	41,746	--	265
Quaking aspen	3,236,405	549,715	9,557	115,918	19,595	518,351	684,905	188,751	652,602	112,222	380,839	2,755	1,195
Basswood	402,424	28,068	--	15,616	3,468	33,974	59,554	9,707	168,628	11,643	70,441	--	1,325
Elm	431,437	13,488	480	8,672	6,698	36,215	45,670	9,776	243,085	7,539	57,562	--	2,252
Select hardwoods	18,316	--	--	--	139	1,873	403	--	13,411	696	1,794	--	--
Other hardwoods	65,668	--	--	62	4,106	4,259	118	--	49,515	958	6,650	--	--
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	7,976,990	1,000,000	14,563	237,983	76,418	1,123,941	1,445,557	370,962	2,322,655	265,590	1,106,711	3,021	9,589
All species	11,453,997	1,871,066	37,377	374,578	96,569	1,942,162	2,012,295	636,003	2,706,209	364,071	1,399,022	3,764	10,881

Table 38.--Net volume of sawtimber on commercial forest land by species group and ownership class, Minnesota, 1977

(In thousand board feet)[1/]

Species	All owners	Ownership class											
		National Forest	Bureau of Land Mgmt.	Indian	Misc. Federal	State	County & municipal	Forest Industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
SOFTWOODS:													
White pine	1,068,372	394,746	1,625	61,881	8,028.	88,087	135,016	71,963	168,052	31,346	103,315	--	4,313
Red pine	1,952,896	827,988	3,970	82,942	5,087	218,637	293,305	76,379	226,166	30,435	187,987	--	--
Jack pine	1,566,444	420,047	26,103	26,010	14,712	295,928	236,124	87,328	253,477	41,542	164,294	879	--
White spruce	648,730	183,093	7,353	20,503	5,391	91,818	118,397	55,945	73,495	22,259	70,008	468	--
Black spruce	460,401	139,187	2,280	7,237	4,580	163,130	51,093	43,448	19,058	10,444	19,944	--	--
Balsam fir	1,338,249	341,533	1,996	32,973	11,523	216,563	306,820	108,577	147,402	44,961	125,373	--	528
Tamarack	346,508	26,681	1,174	19,298	2,771	130,810	42,638	5,618	80,751	8,936	27,831	--	--
Northern white-cedar	1,142,761	217,274	6,376	57,153	6,510	383,199	165,677	147,545	45,783	28,493	84,751	--	--
Other softwoods	6,228	--	--	--	--	364	--	--	3,581	821	1,462	--	--
Total	8,530,589	2,550,549	50,877	307,997	58,602	1,588,536	1,349,070	596,803	1,017,765	219,237	784,965	1,347	4,841
HARDWOODS:													
Select white oak	1,076,044	25,896	429	13,597	5,372	49,035	41,196	1,220	786,380	18,428	129,610	--	4,881
Select red oak	1,763,622	13,077	--	6,982	11,194	160,531	104,125	5,014	1,084,804	44,897	329,567	--	3,431
Other red oak	56,414	--	--	--	2,058	3,007	290	--	49,371	--	1,688	--	--
Hickory	32,383	--	--	--	637	285	989	--	29,539	--	933	--	--
Yellow birch	39,926	1,606	--	--	--	2,755	22,413	3,290	903	4,502	4,457	--	--
Hard maple	489,619	6,668	--	9,720	3,869	71,846	81,504	16,620	208,839	3,841	86,712	--	--
Soft maple	281,998	10,900	--	1,088	81,748	20,518	29,770	5,038	94,607	5,418	32,911	--	--
Ash	993,952	88,212	2,258	20,646	20,577	129,499	156,737	52,598	357,578	24,091	140,943	--	813
Balsam poplar	1,101,406	144,889	1,916	37,980	3,937	206,987	253,307	74,119	244,099	30,580	102,188	523	881
Paper birch	1,234,388	276,079	1,058	50,296	16,037	185,600	197,057	75,316	203,453	41,735	187,447	--	310
Bigtooth aspen	303,391	12,135	--	3,767	695	40,387	51,585	18,943	92,045	13,876	69,218	--	740
Quaking aspen	5,671,280	1,068,447	21,668	205,049	39,243	836,043	1,219,322	356,277	1,042,614	234,038	642,280	2,168	4,131
Basswood	1,116,835	36,841	--	33,986	8,114	83,137	106,332	15,521	588,125	27,875	210,393	--	6,511
Elm	1,607,307	55,474	1,777	23,756	28,484	117,399	151,743	37,656	942,695	25,310	212,793	--	10,220
Select hardwoods	40,192	--	--	--	440	3,129	--	--	30,534	1,591	4,498	--	--
Other hardwoods	267,851	--	--	304	22,293	14,959	--	--	204,298	3,026	22,971	--	--
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	16,076,608	1,740,224	29,106	407,171	244,698	1,925,117	2,416,370	661,612	5,959,884	479,208	2,178,609	2,691	31,918
All species	24,607,197	4,290,773	79,983	715,168	303,300	3,513,653	3,765,440	1,258,415	6,977,649	698,445	2,963,574	4,038	36,759

[1/]International 1/4-inch rule.

Table 39.--Net volume of growing stock on commercial forest land by forest type and stand-age class, Minnesota, 1977

(In thousand cubic feet)

Forest type	All classes	Stand-age class (years) 0-10	11-20	21-30	31-40	41-50	51-60
Jack pine	560,341	4,681	3,194	24,517	115,786	143,135	147,803
Red pine	379,361	2,491	6,730	8,577	40,312	32,630	33,291
White pine	104,078	--	491	--	1,329	10,419	7,950
Balsam fir	679,143	12,674	18,644	31,363	65,442	211,002	193,493
White spruce	49,960	304	384	1,721	4,189	15,454	11,761
Black spruce	493,495	3,624	17,395	32,662	39,987	61,332	101,045
Northern white-cedar	378,567	551	1,833	5,010	10,351	10,892	25,634
Tamarack	203,820	3,117	13,425	9,423	7,848	20,980	40,830
Oak-hickory	784,286	4,577	9,899	2,910	53,113	136,848	133,132
Elm-ash-cottonwood	584,282	9,677	14,165	14,278	18,361	67,374	102,512
Maple-basswood	1,212,875	8,049	14,472	15,438	80,412	173,660	234,623
Aspen	4,681,925	159,232	149,722	250,317	816,553	1,443,009	1,151,136
Paper birch	919,682	5,063	14,592	16,703	95,456	271,439	240,579
Balsam poplar	407,592	13,990	15,138	18,044	64,316	131,327	79,004
Nonstocked	14,590	13,886	151	--	106	348	--
All types	11,453,997	241,916	280,235	430,963	1,413,561	2,729,849	2,502,793

(Table 39 continued)

Forest type	Stand-age class (years) 61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	87,204	9,132	12,811	9,533	2,545	--	--
Red pine	19,727	138,196	32,424	62,010	2,973	--	--
White pine	14,846	23,017	4,335	27,989	13,702	--	--
Balsam fir	88,787	29,075	11,850	13,682	3,131	--	--
White spruce	4,956	1,530	3,496	5,173	992	--	--
Black spruce	58,575	73,907	45,927	37,959	8,520	12,562	--
Northern white-cedar	47,916	33,323	55,880	53,773	46,602	84,195	2,607
Tamarack	17,067	17,772	18,679	6,886	29,083	18,204	506
Oak-hickory	138,917	92,210	78,731	82,756	45,926	5,267	--
Elm-ash-cottonwood	92,916	65,691	81,035	63,515	30,253	24,505	--
Maple-basswood	206,122	181,780	93,862	101,704	64,500	38,253	--
Aspen	472,625	144,095	68,134	20,870	3,743	2,489	--
Paper birch	118,869	84,430	51,101	14,231	7,219	--	--
Balsam poplar	46,627	27,224	10,434	1,488	--	--	--
Nonstocked	--	99	--	--	--	--	--
All types	1,415,154	921,481	568,699	501,569	259,189	185,475	3,113

Table 40.--Net volume of sawtimber on commercial forest land by forest type and stand-age class, Minnesota, 1977

(In thousand board feet)[1/]

Forest type	All ages	Stand-age class (years) 0-10	11-20	21-30	31-40	41-50	51-60
Jack pine	1,288,869	9,343	6,218	22,324	199,816	312,645	416,610
Red pine	1,498,128	11,046	11,662	6,336	75,180	98,259	112,932
White pine	491,854	--	3,736	--	3,307	40,202	32,307
Balsam fir	1,250,440	31,237	39,819	55,218	84,935	300,842	368,555
White spruce	133,068	--	--	4,544	6,443	18,527	29,463
Black spruce	404,865	3,928	9,103	13,554	22,714	49,318	86,363
Northern white-cedar	872,938	1,441	2,078	5,006	12,418	21,666	39,144
Tamarack	233,050	2,664	15,628	6,290	4,625	16,338	49,937
Oak-hickory	2,337,948	12,967	28,655	4,203	95,337	221,443	330,599
Elm-ash-cottonwood	1,526,492	13,316	27,471	24,880	38,480	150,895	253,577
Maple-basswood	3,896,085	26,002	29,931	24,429	155,330	348,427	655,637
Aspen	8,336,377	279,718	193,790	285,176	1,006,672	2,267,161	2,393,445
Paper birch	1,473,241	4,202	18,308	25,903	121,683	308,558	337,528
Balsam poplar	829,199	18,472	22,751	11,642	84,769	232,380	183,650
Nonstocked	34,643	32,595	417	--	--	895	--
All types	24,607,197	446,931	409,567	489,505	1,911,709	4,387,556	5,289,747

[1/] International 1/4-inch rule.

(Table 40 continued)

Forest type	Stand-age class (years) 61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	219,381	37,222	32,780	25,228	7,302	--	--
Red pine	81,587	628,588	134,002	325,654	12,882	--	--
White pine	66,361	116,519	16,464	136,463	76,495	--	--
Balsam fir	209,129	68,266	30,755	52,692	8,992	--	--
White spruce	18,619	5,938	16,568	28,260	4,706	--	--
Black spruce	40,053	97,774	40,778	23,422	8,775	9,083	--
Northern white-ceda	78,320	69,199	127,068	102,695	121,903	282,482	9,518
Tamarack	20,194	30,466	24,210	9,891	37,176	15,631	--
Oak-hickory	429,357	317,402	318,135	356,212	200,068	23,570	--
Elm-ash-cottonwood	240,906	195,014	208,672	200,558	79,853	92,870	--
Maple-basswood	732,621	738,672	390,415	353,538	291,066	150,017	--
Aspen	1,175,188	414,623	238,771	64,547	9,726	7,560	--
Paper birch	213,109	207,572	169,931	45,217	21,230	--	--
Balsam poplar	144,776	88,977	36,899	4,883	--	--	--
Nonstocked	--	736	--	--	--	--	--
All types	3,669,601	3,016,968	1,785,448	1,729,260	880,174	581,213	9,518

Table 41.--Net volume of sawtimber on commercial forest land by species group and butt log-grade class, Minnesota, 1977

(In thousand board feet)[1/]

Species	All grades	Log grade 1	Log grade 2	Log grade 3	Tie and timber
SOFTWOODS:					
White pine	1,068,372	211,735	181,862	647,933	26,842
Red pine	1,952,896	294,630	386,324	1,271,684	258
Jack pine	1,566,444	3,234	84,359	1,478,761	90
White spruce	648,730	3,319	26,715	618,550	146
Black spruce	460,401	4,248	33,422	422,653	78
Balsam fir	1,338,249	--	28,214	1,310,035	--
Tamarack	346,508	1,550	26,669	318,253	36
Northern white-cedar	1,142,761	14,633	74,190	1,053,938	--
Other softwoods	6,228	29	46	6,153	--
Total softwoods	8,530,589	533,378	841,801	7,127,960	27,450
HARDWOODS:					
Select white oak	1,076,044	75,495	229,741	660,706	110,102
Select red oak	1,763,622	149,129	443,202	1,074,625	96,666
Other red oak	56,414	3,025	13,976	30,339	9,074
Hickory	32,383	180	9,797	21,174	1,232
Yellow birch	39,926	6,015	11,149	22,709	53
Hard maple	489,619	35,997	93,628	337,986	22,008
Soft maple	281,998	24,428	63,439	190,360	3,771
Ash	993,952	93,017	409,394	464,268	27,273
Balsam poplar	1,101,406	53,550	279,463	694,769	73,624
Paper birch	1,234,388	75,719	365,594	739,461	53,614
Bigtooth aspen	303,391	17,251	62,675	206,132	17,333
Quaking aspen	5,671,280	159,061	1,121,044	3,992,697	398,478
Basswood	1,116,835	207,585	480,260	417,441	11,549
Elm	1,607,307	251,297	554,755	761,341	39,914
Select hardwoods	40,192	1,912	7,413	30,867	--
Other hardwoods	267,851	69,418	51,713	146,469	251
Noncommercial species	--	--	--	--	--
Total	16,076,608	1,223,079	4,197,243	9,791,344	864,942
All species	24,607,197	1,756,457	5,039,044	16,919,304	892,392

[1/]International 1/4-inch rule.

Table 42.--Net volume of short-log trees on commercial forest land by species group and diameter class, Minnesota, 1977

(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:											
White pine	1,729	311	85	286	420	89	86	--	366	86	--
Red pine	785	191	265	148	--	109	72	--	--	--	--
Jack pine	4,109	1,685	1,201	843	308	72	--	--	--	--	--
White spruce	264	117	66	--	81	--	--	--	--	--	--
Black spruce	1,208	951	91	--	166	--	--	--	--	--	--
Balsam fir	4,229	2,674	530	141	236	648	--	--	--	--	--
Tamarack	2,462	1,343	887	83	61	88	--	--	--	--	--
Northern white-cedar	11,883	4,538	3,529	1,256	1,115	1,007	267	83	88	--	--
Other softwoods	391	248	--	--	73	--	70	--	--	--	--
Total	27,060	12,058	6,654	2,757	2,460	2,013	495	83	454	86	--
HARDWOODS:											
Select white oak	16,071	--	3,734	2,337	3,373	1,761	1,474	1,450	1,322	620	--
Select red oak	13,346	--	2,965	3,523	2,109	1,765	721	1,139	976	148	--
Other red oak	385	--	43	115	--	71	89	67	--	--	--
Hickory	200	--	37	96	--	--	67	--	--	--	--
Yellow birch	2,057	--	176	568	88	211	--	90	924	--	--
Hard maple	10,015	--	1,980	2,855	2,135	861	1,249	248	597	90	--
Soft maple	3,388	--	185	530	428	315	487	178	479	437	349
Ash	5,367	--	2,381	1,244	1,073	354	56	99	114	46	--
Balsam poplar	5,239	--	1,630	1,207	400	1,379	254	225	107	--	37
Paper birch	11,929	--	5,092	2,830	2,578	511	661	134	123	--	--
Bigtooth aspen	3,398	--	1,222	1,100	405	671	--	--	--	--	--
Quaking aspen	60,256	--	26,475	15,301	10,405	5,368	1,900	371	432	4	--
Basswood	7,295	--	2,117	1,452	1,242	588	486	262	1,020	128	--
Elm	15,294	--	3,235	1,865	1,834	1,414	1,513	1,104	2,320	1,377	632
Select hardwoods	489	--	6	83	181	73	--	45	101	--	--
Other hardwoods	2,668	--	540	616	168	204	84	62	283	171	540
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--
Total	157,397	--	51,818	35,722	26,419	15,546	9,041	5,474	8,798	3,021	1,558
All species	184,457	12,058	58,472	38,479	28,879	17,559	9,536	5,557	9,252	3,107	1,558

Table 43.--Net volume of short-log trees on commercial forest land by species group and diameter class, Minnesota, 1977

(In thousand board feet)[1/]

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:											
White pine	6,237	1,181	387	1,034	1,792	411	213	--	889	330	--
Red pine	2,874	684	1,246	516	--	254	174	--	--	--	--
Jack pine	14,430	6,339	4,642	2,165	965	319	--	--	--	--	--
White spruce	1,513	754	332	--	427	--	--	--	--	--	--
Black spruce	3,770	3,184	368	--	218	--	--	--	--	--	--
Balsam fir	13,467	8,498	2,168	394	1,337	1,070	--	--	--	--	--
Tamarack	7,773	3,820	2,862	180	455	456	--	--	--	--	--
Northern white-cedar	41,088	17,962	12,155	3,915	2,990	2,794	665	207	400	--	--
Other softwoods	1,716	1,384	--	--	165	--	167	--	--	--	--
Total	92,868	43,806	24,160	8,204	8,349	5,304	1,219	207	1,289	330	--
HARDWOODS:											
Select white oak	55,764	--	15,181	8,066	10,936	5,910	4,071	4,460	4,846	2,294	--
Select red oak	40,661	--	10,434	10,694	6,602	4,769	1,717	3,323	2,595	527	--
Other red oak	1,253	--	138	474	--	201	250	190	--	--	--
Hickory	700	--	119	381	--	--	200	--	--	--	--
Yellow birch	4,678	--	556	1,809	177	838	--	435	863	--	--
Hard maple	26,164	--	5,278	7,203	5,308	2,019	2,965	848	2,264	279	--
Soft maple	11,058	--	758	2,426	1,674	1,023	1,443	434	1,145	1,097	1,058
Ash	12,715	--	6,388	3,002	1,924	583	143	193	234	248	--
Balsam poplar	18,654	--	3,957	3,516	867	6,307	1,518	1,489	517	--	483
Paper birch	35,137	--	13,967	8,029	5,595	1,627	4,300	1,024	595	--	--
Bigtooth aspen	8,291	--	2,685	2,654	1,061	1,891	--	--	--	--	--
Quaking aspen	172,196	--	70,814	40,809	33,047	17,143	7,507	1,173	1,700	3	--
Basswood	18,770	--	4,526	2,785	2,515	1,479	1,047	833	4,596	989	--
Elm	58,460	--	13,939	7,758	6,914	5,506	4,379	3,479	8,038	4,944	3,503
Select hardwoods	1,656	--	56	30	743	386	--	203	238	--	--
Other hardwoods	15,221	--	3,327	3,257	1,260	1,089	584	363	912	1,059	3,370
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--
Total	481,378	--	152,123	102,893	78,623	50,771	30,124	18,447	28,543	11,440	8,414
All species	574,246	43,806	176,283	111,097	86,972	56,075	31,343	18,654	29,832	11,770	8,414

[1/]International 1/4-inch rule.

Table 44.--Net annual growth of growing stock on commercial forest land by softwoods and hardwoods, Minnesota, 1962[1/] and 1976

(In thousand cubic feet)

Species	1962	1976
Softwoods:	106,789	119,781
Hardwoods:	257,420	229,139
All species	364,209	348,920

[1/]Figures have been adjusted from those published after the 1962 survey to conform to 1977 volumes because of changes in survey definitions and procedures.

Table 45.--Net annual growth of growing stock on commercial forest land by species group and Forest Survey Unit, Minnesota, 1976

(In thousand cubic feet)

Species	All units	Aspen-Birch	Northern Pine	Central Hardwood	Prairie
SOFTWOODS:					
White pine	5,599	2,367	2,779	453	--
Red pine	15,684	5,811	8,742	1,113	18
Jack pine	25,677	5,799	19,216	649	13
White spruce	10,701	7,328	3,228	126	19
Black spruce	16,520	11,358	4,947	211	4
Balsam fir	31,902	17,912	13,570	402	18
Tamarack	2,269	(-)343	2,092	508	12
Northern white-cedar	11,274	6,747	4,527	--	--
Other softwoods	155	3	22	100	30
Total	119,781	56,982	59,123	3,562	114
HARDWOODS:					
Select white oak	8,733	140	3,213	4,294	1,086
Select red oak	15,691	191	6,034	9,025	441
Other red oak	256	--	29	214	13
Hickory	455	--	12	429	14
Yellow birch	118	30	85	3	--
Hard maple	8,660	1,298	2,535	4,335	492
Soft maple	6,454	1,574	1,813	2,940	127
Ash	9,468	3,996	3,621	1,538	313
Balsam poplar	17,757	6,229	9,429	833	1,266
Paper birch	30,290	10,619	15,829	3,761	81
Bigtooth aspen	1,086	409	341	332	4
Quaking aspen	93,083	31,322	45,739	11,430	4,592
Basswood	17,252	891	6,228	8,516	1,617
Elm	18,022	1,248	5,617	10,307	850
Select hardwoods	440	4	73	306	57
Other hardwoods	1,374	(-)34	71	470	867
Noncommercial species	--	--	--	--	--
Total	229,139	57,917	100,669	58,733	11,820
All species	348,920	114,899	159,792	62,295	11,934

Table 46.--Net annual growth of sawtimber on commercial forest land by species group and Forest Survey Unit, Minnesota, 1976

(In thousand board feet)[1/]

Species	All units	Aspen-Birch	Northern Pine	Central Hardwood	Prairie
SOFTWOODS:					
White pine	33,304	15,969	14,775	2,560	--
Red pine	74,768	25,414	48,197	1,064	93
Jack pine	88,650	30,665	56,971	981	33
White spruce	36,750	23,581	12,764	347	58
Black spruce	18,568	14,758	3,800	10	--
Balsam fir	86,053	48,647	36,542	864	--
Tamarack	8,460	6	5,698	2,743	13
Northern white-cedar	33,003	19,486	13,517	--	--
Other softwoods	763	--	664	71	28
Total	380,319	178,526	192,928	8,640	225
HARDWOODS:					
Select white oak	30,845	199	9,585	16,546	4,515
Select red oak	61,191	658	19,759	38,201	2,573
Other red oak	960	--	3	909	48
Hickory	1,484	--	6	1,456	22
Yellow birch	612	428	166	18	--
Hard maple	30,649	2,639	6,239	19,508	2,263
Soft maple	18,380	1,574	3,278	10,481	3,047
Ash	18,003	6,377	5,340	5,078	1,208
Balsam poplar	51,922	22,274	25,742	812	3,094
Paper birch	53,434	23,611	26,074	3,715	34
Bigtooth aspen	11,116	1,130	10,651	(-)665	--
Quaking aspen	330,071	132,104	157,084	34,262	6,621
Basswood	48,788	2,452	12,042	27,208	7,086
Elm	61,699	6,113	18,524	34,852	2,210
Select hardwoods	2,261	--	444	1,564	253
Other hardwoods	9,730	(-)19	287	3,358	6,104
Noncommercial species	--	--	--	--	--
Total	731,145	199,540	295,224	197,303	39,078
All species	1,111,464	378,066	488,152	205,943	39,303

[1/]International 1/4-inch rule.

Table 47.--Net annual growth of growing stock on commercial forest land by species group and ownership class, Minnesota, 1976

(In thousand cubic feet)

Species	All owners	Ownership class											
		National Forest	Bureau of Land Mgmt.	Indian	Misc. Federal	State	County & municipal	Forest Industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
SOFTWOODS:													
White pine	5,599	1,555	27	488	1	382	911	432	1,003	182	581	--	37
Red pine	15,684	6,044	158	630	16	1,582	2,040	1,009	1,565	235	2,405	--	--
Jack pine	25,677	4,407	410	543	387	3,870	4,368	2,911	4,738	960	3,073	10	--
White spruce	10,701	1,965	75	269	85	3,222	1,978	688	1,148	298	960	13	--
Black spruce	16,520	2,827	139	550	98	6,155	3,051	1,232	1,093	509	850	16	--
Balsam fir	31,902	6,364	34	1,350	206	5,974	9,690	1,278	3,728	950	2,317	--	11
Tamarack	2,269	538	11	61	43	340	325	210	(-)175	249	667	--	--
Northern white-cedar	11,274	1,411	131	1,289	47	4,288	1,287	1,112	733	230	746	--	--
Other softwoods	155	--	--	--	--	49	3	--	78	20	5	--	--
Total	119,781	25,111	985	5,180	883	25,862	23,653	8,872	13,911	3,633	11,604	39	48
HARDWOODS:													
Select white oak	8,733	178	2	212	32	761	565	45	5,727	196	988	--	27
Select red oak	15,691	388	--	195	109	1,535	1,558	200	6,938	311	4,412	--	45
Other red oak	256	--	--	--	6	29	16	--	193	--	12	--	--
Hickory	455	--	--	8	9	6	4	--	385	--	43	--	--
Yellow birch	118	(-)84	--	--	--	22	94	14	14	18	40	--	--
Hard maple	8,660	208	--	174	54	1,461	631	(-)36	3,984	302	1,874	3	5
Soft maple	6,454	1,104	--	73	409	884	816	140	1,546	177	1,305	--	--
Ash	9,468	2,189	32	404	(-)62	1,434	767	(-)9	2,371	393	1,944	--	5
Balsam poplar	17,757	2,247	201	1,445	502	3,126	2,586	483	4,582	792	1,781	7	5
Paper birch	30,290	2,886	47	788	220	4,433	7,066	1,870	6,458	1,472	5,012	1	37
Bigtooth aspen	1,086	(-)1	7	81	13	1,221	(-)764	(-)525	182	226	639	--	7
Quaking aspen	93,083	15,412	430	4,006	794	19,028	12,866	4,162	19,933	1,267	15,211	(-)64	38
Basswood	17,252	911	--	530	116	1,265	2,383	298	8,012	504	3,165	--	68
Elm	18,022	354	23	451	218	1,717	1,938	385	9,782	474	2,520	--	160
Select hardwoods	440	--	--	--	3	75	20	--	254	21	67	--	--
Other hardwoods	1,374	--	--	1	105	193	4	--	789	40	242	--	--
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	229,139	25,792	742	8,368	2,528	37,190	30,550	7,027	71,150	6,193	39,255	(-)53	397
All species	348,920	50,903	1,727	13,548	3,411	63,052	54,203	15,899	85,061	9,826	50,859	(-)14	445

Table 48.--Net annual growth of sawtimber on commercial forest land by species group and ownership class, Minnesota, 1976

(In thousand board feet)[1/]

Species	All owners	Ownership class											
		National Forest	Bureau of Land Mgmt.	Indian	Misc. Federal	State	County & municipal	Forest Industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
SOFTWOODS:													
White pine	33,304	12,806	64	2,017	(-)39	1,755	4,177	2,914	5,877	800	2,822	--	111
Red pine	74,768	30,280	932	3,486	109	6,532	12,338	4,638	7,800	902	7,751	--	--
Jack pine	88,650	25,996	1,909	58	400	12,350	12,722	8,228	16,617	746	9,597	27	--
White spruce	36,750	7,226	401	1,130	275	6,373	6,976	1,727	6,183	1,302	5,096	61	--
Black spruce	18,568	9,481	45	113	135	3,183	1,898	1,476	1,624	298	315	--	--
Balsam fir	86,053	21,684	58	1,460	263	15,806	22,240	6,201	9,975	(-)109	8,459	--	16
Tamarack	8,460	1,351	19	82	77	824	1,845	154	389	224	3,495	--	--
Northern white-cedar	33,003	8,653	119	2,113	131	11,372	4,024	2,568	777	1,212	2,034	--	--
Other softwoods	763	--	--	--	--	664	--	--	68	14	17	--	--
Total	380,319	117,477	3,547	10,459	1,351	58,859	66,220	27,906	49,310	5,389	39,586	88	127
HARDWOODS:													
Select white oak	30,845	699	8	215	75	1,518	1,496	13	23,298	958	2,463	--	102
Select red oak	61,191	488	--	523	544	5,903	4,033	1,171	33,633	(-)364	15,195	--	65
Other red oak	960	--	--	--	31	53	1	--	840	--	35	--	--
Hickory	1,484	--	--	--	16	8	13	--	1,423	--	24	--	--
Yellow birch	612	154	--	--	--	38	239	42	17	61	61	--	--
Hard maple	30,649	626	--	738	135	2,941	2,380	644	19,894	93	3,198	--	--
Soft maple	18,380	1,171	--	13	1,499	745	464	53	10,497	95	3,843	--	--
Ash	18,003	2,590	35	318	2,423	3,362	3,728	(-)18	1,222	383	3,948	--	12
Balsam poplar	51,922	5,790	711	2,691	99	10,073	13,087	3,484	13,396	842	1,688	33	28
Paper birch	53,434	14,865	5	1,537	673	3,324	7,402	3,732	12,032	963	8,895	--	6
Bigtooth aspen	11,116	1,533	--	832	13	3,015	(-)207	853	1,273	304	3,488	--	12
Quaking aspen	330,071	59,251	1,868	9,001	2,279	52,228	72,551	19,979	55,609	4,690	52,477	64	74
Basswood	48,788	2,433	--	1,155	210	3,231	3,947	1,042	24,661	2,287	9,521	--	301
Elm	61,699	1,858	56	1,269	307	5,307	7,474	1,437	31,136	1,112	11,053	--	690
Select hardwoods	2,261	--	--	--	2	251	--	--	1,863	38	107	--	--
Other hardwoods	9,730	--	--	4	392	262	--	--	7,562	73	1,437	--	--
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	731,145	91,458	2,683	18,296	8,698	92,259	116,608	32,432	238,356	11,535	117,433	97	1,290
All species	1,111,464	208,935	6,230	28,755	10,049	151,118	182,828	60,338	287,666	16,924	157,019	185	1,417

[1/]International 1/4-inch rule.

Table 49.--Net annual growth of growing stock on commercial forest land by species group and forest type, Minnesota, 1976

(In thousand cubic feet)

Species	All types	Forest type: Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
SOFTWOODS:								
White pine	5,599	119	1,168	1,247	320	35	89	37
Red pine	15,684	1,780	8,797	387	346	42	48	59
Jack pine	25,677	20,768	667	111	172	78	405	87
White spruce	10,701	226	266	267	1,517	1,190	464	34
Black spruce	16,520	438	54	(-)67	2,060	47	11,517	168
Balsam fir	31,902	375	564	(-)532	8,260	188	1,032	169
Tamarack	2,269	5	14	--	129	(-)819	732	84
Northern white-cedar	11,274	--	11	8	1,334	43	376	6,959
Other softwoods	155	--	25	--	--	--	10	--
Total	119,781	23,711	11,566	1,421	14,138	804	14,673	7,597
HARDWOODS:								
Select white oak	8,733	31	8	14	18	1	--	--
Select red oak	15,691	94	33	15	4	--	6	--
Other red oak	256	--	--	--	--	--	--	--
Hickory	455	--	--	--	--	--	--	--
Yellow birch	118	--	--	--	7	--	--	15
Hard maple	8,660	--	--	3	19	--	--	--
Soft maple	6,454	146	3	41	44	--	6	1
Ash	9,468	2	6	13	261	(-)310	50	(-)24
Balsam poplar	17,757	33	36	4	(-)819	34	40	198
Paper birch	30,290	495	411	(-)24	2,344	296	239	150
Bigtooth aspen	1,086	(-)576	(-)118	1	14	--	88	10
Quaking aspen	93,083	1,655	(-)30	196	2,261	480	1,143	117
Basswood	17,252	5	--	11	36	--	--	--
Elm	18,022	8	3	--	69	(-)129	6	5
Select hardwoods	440	--	--	--	--	--	--	--
Other hardwoods	1,374	12	4	--	--	--	--	--
Noncommercial species	--	--	--	--	--	--	--	--
Total	229,139	1,905	356	274	4,258	372	1,578	472
All species	348,920	25,616	11,922	1,695	18,396	1,176	16,251	8,069

(Table 49 continued)

Species	Forest type: Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
SOFTWOODS:								
White pine	54	87	53	332	1,558	491	9	--
Red pine	13	245	14	20	3,172	745	16	--
Jack pine	32	252	21	1	2,687	292	22	82
White spruce	52	(-)49	149	318	5,143	816	308	--
Black spruce	840	--	54	(-)17	1,338	(-)4	78	14
Balsam fir	133	30	584	554	14,662	4,339	1,335	209
Tamarack	2,690	4	(-)402	109	(-)240	(-)104	37	30
Northern white-cedar	192	--	882	130	1,107	2	219	11
Other softwoods	--	71	4	28	--	9	8	--
Total	4,006	640	1,359	1,475	29,427	6,586	2,032	346
HARDWOODS:								
Select white oak	--	3,983	174	1,311	2,895	245	48	5
Select red oak	7	8,207	348	1,759	4,293	906	19	--
Other red oak	--	172	4	38	38	1	3	--
Hickory	--	363	--	75	--	17	--	--
Yellow birch	--	--	36	20	7	31	2	--
Hard maple	--	390	249	6,464	1,212	269	52	2
Soft maple	14	275	882	1,197	2,914	916	15	--
Ash	16	240	4,202	1,317	2,895	399	385	16
Balsam poplar	121	95	556	(-)293	7,395	616	9,819	(-)78
Paper birch	80	1,486	370	1,669	10,854	11,349	528	43
Bigtooth aspen	--	351	32	(-)88	1,977	(-)618	13	--
Quaking aspen	(-)47	1,033	236	1,609	81,400	921	2,033	76
Basswood	--	1,772	442	11,089	3,315	566	16	--
Elm	86	1,632	2,267	8,762	3,871	762	646	34
Select hardwoods	--	132	26	162	98	16	3	3
Other hardwoods	--	139	933	187	80	--	13	6
Noncommercial species	--	--	--	--	--	--	--	--
Total	277	20,270	10,757	35,278	123,244	16,396	13,595	107
All species	4,283	20,910	12,116	36,753	152,671	22,982	15,627	453

Table 50.--Net annual growth of sawtimber on commercial forest land by species group and forest type, Minnesota, 1976

(In thousand board feet)[1/]

Species	All types	Forest type: Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
SOFTWOODS:								
White pine	33,304	356	8,612	9,399	1,653	215	497	255
Red pine	74,768	6,511	40,989	2,353	1,539	104	204	636
Jack pine	88,650	62,359	1,673	215	544	193	3,219	375
White spruce	36,750	365	1,008	2,110	5,639	3,452	897	(-)24
Black spruce	18,568	670	16	30	4,272	23	4,961	(-)188
Balsam fir	86,053	166	2,183	210	19,181	482	2,032	483
Tamarack	8,460	24	10	--	1,201	(-)2,795	2,718	240
Northern white-cedar	33,003	--	36	8	4,679	170	1,674	11,945
Other softwoods	763	--	--	--	--	--	--	--
Total	380,319	70,451	54,527	14,325	38,708	1,844	16,202	13,722
HARDWOODS:								
Select white oak	30,845	7	--	13	36	--	--	--
Select red oak	61,191	37	43	62	5	--	--	--
Other red oak	960	--	--	--	--	--	--	--
Hickory	1,484	--	--	--	--	--	--	--
Yellow birch	612	--	--	--	6	--	--	24
Hard maple	30,649	--	--	17	--	--	--	--
Soft maple	18,380	--	--	6	770	--	9	--
Ash	18,003	--	--	9	303	(-)1,516	114	130
Balsam poplar	51,922	42	--	--	1,140	14	22	971
Paper birch	53,434	1,062	1,607	42	3,917	400	33	115
Bigtooth aspen	11,116	26	5	--	24	--	7	10
Quaking aspen	330,071	3,498	1,341	(-)355	6,006	346	2,877	266
Basswood	48,788	--	--	25	88	--	--	--
Elm	61,699	13	--	--	133	(-)520	--	21
Select hardwoods	2,261	--	--	--	--	--	--	--
Other hardwoods	9,730	--	--	--	--	--	--	--
Noncommercial species	--	--	--	--	--	--	--	--
Total	731,145	4,685	2,996	(-)181	12,429	(-)1,276	3,061	1,537
All species	1,111,464	75,136	57,523	14,144	51,136	568	19,264	15,259

[1/]International 1/4-inch rule.

(Table 50 continued)

Species	Forest type							
	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
SOFTWOODS:								
White pine	259	445	277	1,667	7,179	2,435	55	--
Red pine	61	765	24	113	17,685	3,705	79	--
Jack pine	50	325	38	(-)18	18,930	629	(-)158	276
White spruce	85	(-)365	883	1,330	15,688	3,970	1,712	--
Black spruce	348	--	38	715	7,318	212	129	24
Balsam fir	173	14	(-)342	6,472	39,017	9,676	5,446	860
Tamarack	7,270	26	(-)632	192	(-)972	650	494	34
Northern white-cedar	1,333	--	3,734	1,111	7,752	(-)58	588	31
Other softwoods	--	69	15	30	--	--	649	--
Total	9,579	1,279	4,035	11,612	112,597	21,219	8,994	1,225
HARDWOODS:								
Select white oak	--	13,612	559	7,536	8,107	882	81	12
Select red oak	39	34,649	20	6,967	15,184	4,120	65	--
Other red oak	--	702	23	187	31	--	17	--
Hickory	--	473	--	949	--	62	--	--
Yellow birch	--	--	105	404	7	60	6	--
Hard maple	--	766	215	27,199	1,900	540	12	--
Soft maple	--	1,978	5,668	1,682	8,151	116	--	--
Ash	--	279	7,714	3,970	3,567	1,486	1,915	32
Balsam poplar	141	127	1,109	1,811	18,374	3,315	24,856	--
Paper birch	16	1,152	1,220	4,607	23,456	15,660	138	9
Bigtooth aspen	--	633	51	(-)117	11,700	)1,223	--	--
Quaking aspen	80	5,180	883	5,008	286,167	8,485	10,116	173
Basswood	--	5,328	2,089	36,014	3,989	1,191	64	--
Elm	29	2,575	10,634	28,735	16,165	1,828	1,990	96
Select hardwoods	--	1,681	9	457	81	33	--	--
Other hardwoods	--	146	5,332	4,168	66	--	--	18
Noncommercial species	--	--	--	--	--	--	--	--
Total	305	69,280	35,631	129,578	396,945	36,555	39,260	340
All species	9,884	70,560	39,666	141,189	509,542	57,774	48,254	1,565

Table 51.--Net annual growth of growing stock on commercial forest land by forest type and stand-age class, Minnesota, 1976

(In thousand cubic feet)

Forest type	All ages	Stand-age class (years) 0-10	11-20	21-30	31-40	41-50	51-60
Jack pine	25,616	111	17	3,146	7,134	6,722	5,410
Red pine	11,922	100	836	767	2,331	1,102	1,262
White pine	1,695	(-)29	20	--	88	608	123
Balsam fir	18,396	410	280	1,026	2,883	7,584	3,295
White spruce	1,176	(-)395	30	116	217	(-)94	861
Black spruce	16,251	75	742	1,123	1,369	2,377	3,595
Northern white-cedar	8,069	22	67	137	190	100	855
Tamarack	4,283	103	337	130	322	489	913
Oak-hickory	20,910	43	364	(-)18	1,812	4,911	3,929
Elm-ash-cottonwood	12,116	(-)689	523	500	1,000	2,599	1,935
Maple-basswood	36,753	186	465	907	3,809	5,367	7,969
Aspen	152,671	(-)1,571	7,875	13,982	34,047	46,803	35,933
Paper birch	22,982	110	697	705	2,782	8,228	5,039
Balsam poplar	15,627	397	779	1,520	3,516	4,762	2,258
Nonstocked	453	524	6	--	(-)98	19	--
All types	348,920	(-)603	13,038	24,041	61,402	91,577	73,377

(Table 51 continued)

Forest Type	Stand-age class (years) 61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	2,882	284	(-)86	(-)53	49	--	--
Red pine	649	3,084	620	1,089	82	--	--
White pine	479	265	138	(-)210	213	--	--
Balsam fir	2,841	174	(-)370	173	100	--	--
White spruce	191	30	99	101	20	--	--
Black spruce	1,930	2,233	1,313	1,019	94	381	--
Northen white-cedar	1,241	784	1,539	942	618	1,492	82
Tamarak	587	306	(-)309	144	880	369	12
Oak-hikory	3,876	2,574	557	1,809	922	131	--
Elm-ash-cottonwood	1,822	588	1,760	1,131	511	436	--
Maple-basswood	6,685	4,734	2,681	2,306	706	938	--
Aspen	11,096	2,881	1,099	400	65	61	--
Paper birch	2,662	1,797	774	35	153	--	--
Balsam poplar	1,215	822	318	40	--	--	--
Nonstocked	--	2	--	--	--	--	--
All types	38,156	20,558	10,133	8,926	4,413	3,808	94

Table 52.--Net annual growth of sawtimber on commercial forest land by forest type and stand-age class, Minnesota, 1976

(In thousand board feet)[1/]

Forest type	All ages	Stand-age class (years) 0-10	11-20	21-30	31-40	41-50	51-60
Jack pine	75,136	(-)567	719	1,967	15,932	24,704	19,078
Red pine	57,523	360	1,165	372	6,891	4,925	5,904
White pine	14,144	--	131	--	664	1,310	804
Balsam fir	51,136	1,594	455	1,331	5,471	16,623	16,663
White spruce	568	(-)2,036	--	261	198	(-)1,866	981
Black spruce	19,264	94	777	848	1,528	2,797	6,609
Northern white-cedar	15,259	33	48	103	(-)1	(-)696	794
Tamarack	9,884	61	836	166	121	1,965	3,510
Oak-hickory	70,560	(-)152	754	97	3,270	10,004	11,277
Elm-ash-cottonwood	39,666	(-)305	693	1,020	2,027	10,460	3,939
Maple-basswood	141,189	2,116	3,654	(-)276	12,363	13,065	29,692
Aspen	509,542	3,970	15,151	30,531	79,956	166,023	132,793
Paper birch	57,774	182	435	1,455	6,578	19,370	11,100
Balsam poplar	48,254	(-)1,482	341	375	7,199	18,166	9,914
Nonstocked	1,565	1,524	5	--	--	20	--
All types	1,111,464	5,392	25,164	38,250	142,197	286,870	253,058

[1/] International 1/4-inch rule.

(Table 52 continued)

Forest type	Stand-age class (years) 61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	9,840	1,233	986	1,121	123	--	--
Red pie	2,833	20,814	4,892	8,657	710	--	--
White pine	3,019	2,586	444	3,926	1,260	--	--
Balsam fir	5,691	3,255	(-)686	509	230	--	--
White spruce	1,444	117	381	988	100	--	--
Black spruce	1,308	2,631	774	1,603	157	138	--
Northen white-cedar	2,753	2,255	4,595	1,769	143	3,270	193
Tamarak	494	(-)310	1,208	282	1,247	304	--
Oak-hikory	16,819	13,071	1,890	9,428	3,551	551	--
Elm-ash-cottonwood	4,143	5,014	5,752	3,838	1,329	1,756	--
Maple-basswood	21,401	26,144	13,460	9,366	6,039	4,165	--
Aspen	52,045	17,277	9,437	1,778	451	130	--
Paper birch	7,110	5,656	3,857	1,724	307	--	--
Balsam poplar	9,142	2,709	1,361	529	--	--	--
Nonstocked	--	16	--	--	--	--	--
All types	138,042	102,468	48,351	45,518	15,647	10,314	193

Table 53.--Timber removals[1] from growing stock and sawtimber on commercial forest land by species group, Minnesota, 1962 and 1976

Species	Growing stock		Sawtimber	
	[2]1962	1976	[2]1962	1976
	Thousand cubic feet		[3]Thousand board feet	
SOFTWOODS:				
White pine	3,620	2,910	20,759	13,190
Red pine	3,416	4,177	15,976	15,214
Jack pine	22,678	21,470	54,844	56,934
Spruce	20,589	17,943	45,600	38,809
Balsam fir	12,601	13,893	20,860	27,000
Tamarack	3,485	4,982	6,305	10,165
Northern white-cedar	2,445	3,315	4,586	8,548
Other	66	110	49	82
Total	68,900	68,800	168,979	169,942
HARDWOODS:				
White oak	4,738	5,119	12,763	11,856
Red oak	6,743	10,102	21,149	26,782
Yellow birch	441	16	1,840	41
Hard maple	1,036	1,388	2,534	3,297
Soft maple	1,273	2,840	3,737	5,992
Ash	2,632	5,063	6,781	10,247
Paper birch	3,408	9,113	8,476	13,865
Aspen	45,675	72,979	85,089	172,530
Basswood	2,941	3,529	12,773	10,162
Elm	4,180	7,813	13,872	21,143
Other	3,933	6,838	10,903	14,450
Total	77,000	124,800	179,917	290,365
All species	145,900	193,600	348,896	460,307

1/Removals in 1976 are trend-level removals. "Other" removals from the transfer of commercial forest land to productive-reserved are not included in 1976 removals.

2/Figures have been adjusted from those published after the 1962 survey to conform to 1976 volumes because of changes in survey definitions and procedures.

3/International 1/4-inch rule.

Table 54.--Timber removals[1/] from growing stock and sawtimber on commercial forest land by item and species category, Minnesota, 1976

Item	Growing stock						Sawtimber					
	All species	Jack pine	Spruce	Other soft-woods	Aspen	Other hard-woods	All species	Jack pine	Spruce	Other soft-woods	Aspen	Other hard-woods
	Thousand cubic feet						[2/]Thousand board feet					
ROUNDWOOD PRODUCTS:												
Pulpwood	89,880	13,289	15,188	14,688	42,625	4,090	195,011	26,776	33,977	32,563	99,174	2,521
Saw logs	27,498	5,363	582	4,987	9,006	7,560	135,220	26,743	2,895	27,530	36,805	41,247
Fuelwood	9,065	374	2	135	1,704	6,850	12,683	519	6	195	2,367	9,596
Posts	1,799	723	--	821	20	235	1,206	309	--	347	45	505
Veneer logs	460	--	--	--	65	395	3,059	--	--	--	420	2,639
Poles	610	271	--	339	--	--	1,758	784	--	974	--	--
Other[3/]	5,723	50	--	138	4,607	928	24,986	235	--	729	18,601	5,421
Subtotal	135,035	20,070	15,772	21,108	58,027	20,058	373,923	55,366	36,878	62,338	157,412	61,929
LOGGING RESIDUE:	5,060	418	282	457	2,284	1,619	6,954	299	12	519	1,930	4,194
OTHER REMOVALS:	53,505	982	1,889	7,822	12,668	30,144	79,430	1,269	1,919	11,342	13,188	51,712
TOTAL	193,600	21,470	17,943	29,387	72,979	51,821	460,307	56,934	38,809	74,199	172,530	117,835

[1/]Removals in 1976 are trend-level removals. "Other" removals from the transfer of commercial forest land to productive-reserved are not included in 1976 removals.

[2/]International 1/4-inch rule.

[3/]Includes match bolts, particleboard bolts, shavings bolts, piling, lath bolts, etc.

Table 55.--Timber removals[1/] from growing stock on commercial forest land by species group and Forest Survey Unit, Minnesota, 1976

(In thousand cubic feet)

Species	All units	Aspen-Birch	Northern Pine	Central Hardwood	Prairie
SOFTWOODS:					
White pine	2,910	1,711	1,013	186	--
Red pine	4,177	1,485	2,540	132	20
Jack pine	21,470	10,718	10,259	484	9
White spruce	4,188	2,888	1,265	20	15
Black spruce	13,755	10,275	3,458	21	1
Balsam fir	13,893	7,728	6,040	119	6
Tamarack	4,982	2,503	2,126	304	49
Northern white-cedar	3,315	1,495	1,801	1	18
Other softwoods	110	--	--	72	38
Total	68,800	38,803	28,502	1,339	156
HARDWOODS:					
Select white oak	5,119	10	595	3,136	1,378
Select red oak	9,779	113	1,980	7,255	431
Other red oak	323	--	8	299	16
Hickory	198	--	5	182	11
Yellow birch	16	3	8	5	--
Hard maple	1,388	28	319	813	228
Soft maple	2,840	77	269	2,356	138
Ash	5,063	302	1,237	2,893	631
Balsam poplar	3,078	1,044	1,455	207	372
Paper birch	9,113	3,253	4,540	1,265	55
Bigtooth aspen	3,444	665	2,202	577	--
Quaking aspen	69,535	32,686	30,440	4,965	1,444
Basswood	3,529	48	805	2,000	676
Elm	7,813	207	1,050	4,620	1,936
Select hardwoods	66	--	--	54	12
Other hardwoods	3,496	9	13	2,231	1,243
Noncommercial species	--	--	--	--	--
Total	124,800	38,445	44,926	32,858	8,571
All species	193,600	77,248	73,428	34,197	8,727

[1/]Removals in 1976 are trend-level removals. "Other" removals from the transfer of commercial forest land to productive-reserved are not included in 1976 removals.

Table 56.--Timber removals[1] from sawtimber on commercial forest land by species group and Forest Survey Unit, Minnesota, 1976

(In thousand board feet)[2]

Species	All units	Aspen-Birch	Northern Pine	Central Hardwood	Prairie
SOFTWOODS:					
White pine	13,190	7,641	5,026	523	--
Red pine	15,214	4,210	10,535	405	64
Jack pine	56,934	27,678	27,943	1,296	17
White spruce	12,679	6,368	6,224	54	33
Black spruce	26,130	21,857	4,269	4	--
Balsam fir	27,000	15,329	11,563	108	--
Tamarack	10,165	5,237	4,523	318	87
Northern white-cedar	8,548	4,948	3,568	8	24
Other softwoods	82	--	--	50	32
Total	169,942	93,268	73,651	2,766	257
HARDWOODS:					
Select white oak	11,856	10	1,729	7,494	2,623
Select red oak	25,721	160	4,587	20,026	948
Other red oak	1,061	--	10	1,010	41
Hickory	274	--	9	252	13
Yellow birch	41	14	17	10	--
Hard maple	3,297	39	676	2,103	479
Soft maple	5,992	69	558	4,971	394
Ash	10,247	683	3,353	4,861	1,350
Balsam poplar	4,508	1,165	2,522	603	218
Paper birch	13,865	6,582	6,257	1,012	14
Bigtooth aspen	8,797	1,472	5,473	1,852	--
Quaking aspen	163,733	73,787	76,701	12,708	537
Basswood	10,162	152	2,768	5,353	1,889
Elm	21,143	618	4,073	11,371	5,081
Select hardwoods	374	--	--	298	76
Other hardwoods	9,294	7	22	5,312	3,953
Noncommercial species	--	--	--	--	--
Total	290,365	84,758	108,755	79,236	17,616
All species	460,307	178,026	182,406	82,002	17,873

[1]/Removals in 1976 are trend-level removals. "Other" removals from the transfer of commercial forest land to productive-reserved are not included in 1976 removals.

[2]/International 1/4-inch rule.

Table 57.--Net annual growth and removals[1/] of growing stock on commercial forest land by species group, Minnesota, 1976

(In thousand cubic feet)

Species	Net annual growth	Annual timber removals
SOFTWOODS:		
White pine	5,599	2,910
Red pine	15,684	4,177
Jack pine	25,677	21,470
White spruce	10,701	4,188
Black spruce	16,520	13,755
Balsam fir	31,902	13,893
Tamarack	2,269	4,982
Northern white-cedar	11,274	3,315
Other softwoods	155	110
Total	119,781	68,800
HARDWOODS:		
Select white oak	8,733	5,119
Select red oak	15,691	9,779
Other red oak	256	323
Hickory	455	198
Yellow birch	118	16
Hard maple	8,660	1,388
Soft maple	6,454	2,840
Ash	9,468	5,063
Balsam poplar	17,757	3,078
Paper birch	30,290	9,113
Bigtooth aspen	1,086	3,444
Quaking aspen	93,083	69,535
Basswood	17,252	3,529
Elm	18,022	7,813
Select hardwoods	440	66
Other hardwoods	1,374	3,496
Noncommercial species	--	--
Total	229,139	124,800
All species	348,920	193,600

[1/]Removals in 1976 are trend-level removals. "Other" removals from the transfer of commercial forest land to productive-reserved are not included in 1976 removals.

Table 58.--Net annual growth and removals[1/] of sawtimber on commercial forest land by species group, Minnesota, 1976

(In thousand board feet)[2/]

Species	Net annual growth	Annual timber removals
SOFTWOODS:		
White pine	33,304	13,190
Red pine	74,768	15,214
Jack pine	88,650	56,934
White spruce	36,750	12,679
Black spruce	18,568	26,130
Balsam fir	86,053	27,000
Tamarack	8,460	10,165
Northern white-cedar	33,003	8,548
Other softwoods	763	82
Total	380,319	169,942
HARDWOODS:		
Select white oak	30,845	11,856
Select red oak	61,191	25,721
Other red oak	960	1,061
Hickory	1,484	274
Yellow birch	612	41
Hard maple	30,649	3,297
Soft maple	18,380	5,992
Ash	18,003	10,247
Balsam poplar	51,922	4,508
Paper birch	53,434	13,865
Bigtooth aspen	11,116	8,797
Quaking aspen	330,071	163,733
Basswood	48,788	10,162
Elm	61,699	21,143
Select hardwoods	2,261	374
Other hardwoods	9,730	9,294
Noncommercial species	--	--
Total	731,145	290,365
All species	1,111,464	460,307

[1/]Removals in 1976 are trend-level removals. "Other" removals from the transfer of commercial forest land to productive-reserved are not included in 1976 removals.

[2/]International 1/4-inch rule.

Table 59.--Net annual growth and removals[1/] of growing stock on commercial forest land by ownership class and softwoods and hardwoods, Minnesota, 1976

(In thousand cubic feet)

Owner	Net annual growth			Annual timber removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
FEDERAL						
National Forest	50,903	25,111	25,792	16,423	7,946	8,477
Other federal	18,686	7,048	11,638	5,202	2,686	2,516
Subtotal	69,589	32,159	37,430	21,625	10,632	10,993
STATE						
Total	63,052	25,862	37,190	34,123	18,920	15,203
COUNTY & MUNICIPAL						
Total	54,203	23,653	30,550	18,354	5,753	12,601
PRIVATE						
Forest industry	15,899	8,872	7,027	15,165	7,491	7,674
Farm and other	146,177	29,235	116,942	104,333	26,004	78,329
Subtotal	162,076	38,107	123,969	119,498	33,495	86,003
ALL OWNERS						
Total	348,920	119,781	229,139	193,600	68,800	124,800

[1/]Removals in 1976 are trend-level removals. "Other" removals from the transfer of commercial forest land to productive-reserved are not included in 1976 removals.

Table 60.--Net annual growth and removals[1/] of sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Minnesota, 1976

(In thousand board feet)[2/]

Owner	Net annual growth			Annual timber removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
FEDERAL						
National forest	208,935	117,477	91,458	41,631	21,862	19,769
Other federal	45,034	15,357	29,677	12,926	6,839	6,087
Subtotal	253,969	132,834	121,135	54,557	28,701	25,856
STATE						
Total	151,118	58,859	92,259	90,134	52,004	38,130
COUNTY & MUNICIPAL						
Total	182,828	66,220	116,608	46,436	14,769	31,667
PRIVATE						
Forest industry	60,338	27,906	32,432	34,606	16,845	17,761
Farmer and other	463,211	94,500	368,711	234,574	57,623	176,951
Subtotal	523,549	122,406	401,143	269,180	74,468	194,712
ALL OWNERS						
Total	1,111,464	380,319	731,145	460,307	169,942	290,365

[1/]Removals in 1976 are trend-level removals. "Other" removals from the transfer of commercial forest land to productive-reserved are not included in 1976 removals.

[2/]International 1/4-inch rule.

Table 61.--Annual mortality of growing stock and sawtimber on commercial forest land by species group, Minnesota, 1976

Species	Growing stock	Sawtimber
	Thousand cubic feet	Thousand board feet[1/]
SOFTWOODS:		
White pine	960	2,994
Red pine	110	345
Jack pine	3,322	6,009
White spruce	1,102	3,408
Black spruce	3,899	1,513
Balsam fir	16,774	21,233
Tamarack	5,857	8,748
Northern white-cedar	1,704	6,212
Other	--	--
Total	33,728	50,462
HARDWOODS:		
Select white oak	1,098	3,444
Select red oak	2,993	10,815
Other red oak	--	--
Hickory	--	--
Yellow birch	87	27
Hard maple	1,122	1,003
Soft maple	252	914
Ash	5,071	11,195
Balsam poplar	10,723	17,656
Paper birch	4,870	7,231
Bigtooth aspen	4,841	7,153
Quaking aspen	66,519	110,093
Basswood	1,410	5,043
Elm	8,125	37,957
Select hardwoods	223	--
Other hardwoods	479	--
Noncommercial species	--	--
Total	107,813	212,531
All species	141,541	262,993

[1/] International 1/4-inch rule.

Table 62.--Annual mortality of growing stock on commercial forest land by species group and cause, Minnesota, 1976

(In thousand cubic feet)

Species	All causes	Cause									
		Insects	Disease	Fire	Animals	Weather	Supression	Logging	Timber stand improvement	Land clearing	Unknown and other
Softwoods:											
White pine	960	--	762	109	27	27	--	--	--	--	35
Red pine	110	--	--	--	--	59	--	13	--	--	38
Jack pine	3,322	70	1,862	396	143	353	--	12	--	--	486
White spruce	1,102	101	700	--	26	261	--	--	--	--	14
Black spruce	3,899	173	2,390	--	106	618	--	--	--	--	612
Balsam fir	16,774	5,198	6,775	--	76	2,064	19	51	--	45	2,546
Tamarack	5,857	533	1,570	--	86	677	--	--	--	--	2,991
Northern white-cedar	1,704	--	482	--	--	641	--	56	--	--	525
Other softwoods	--	--	--	--	--	--	--	--	--	--	--
Total	33,728	6,075	14,541	505	464	4,700	19	132	--	45	7,247
HARDWOODS:											
Select white oak	1,098	--	756	--	--	342	--	--	--	--	--
Select red oak	2,993	--	1,039	--	--	1,032	--	214	--	--	708
Other red oak	--	--	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--	--	--
Yellow birch	87	--	87	--	--	--	--	--	--	--	--
Hard maple	1,122	--	858	--	--	--	--	--	264	--	--
Soft maple	252	--	71	--	--	181	--	--	--	--	--
Ash	5,071	--	1,350	159	--	2,437	--	--	310	--	815
Balsam poplar	10,723	--	5,623	84	784	2,595	--	--	--	--	1,637
Paper birch	4,870	80	3,431	120	--	428	--	53	--	--	758
Bigtooth aspen	4,841	--	2,728	--	--	341	--	--	--	--	1,772
Quaking aspen	66,519	612	42,490	6,817	2,259	10,641	--	277	--	--	3,423
Basswood	1,410	--	232	--	--	959	--	104	--	--	115
Elm	8,125	--	7,446	--	--	--	--	7	129	--	543
Select hardwoods	223	--	223	--	--	--	--	--	--	--	--
Other hardwoods	479	--	--	--	--	207	--	--	--	--	272
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--
Total	107,813	692	66,334	7,180	3,043	19,163	--	655	703	--	10,043
All species	141,541	6,767	80,875	7,685	3,507	23,863	19	787	703	45	17,290

Table 63.--Annual mortality of sawtimber on commercial forest land by species group and cause, Minnesota, 1976

(In thousand board feet)[1/]

Species	All causes	Cause									
		Insects	Disease	Fire	Animals	Weather	Supression	Logging	Timber stand improvement	Land clearing	Unknown and other
SOFTWOODS:											
White pine	2,994	--	1,786	682	193	171	--	--	--	--	162
Red pine	345	--	--	--	--	157	--	--	--	--	188
Jack pine	6,009	344	3,195	421	390	620	--	70	--	--	969
White spruce	3,408	237	1,710	--	60	1,401	--	--	--	--	--
Black spruce	1,513	--	721	--	228	464	--	--	--	--	100
Balsam fir	21,233	7,386	5,302	--	112	3,932	--	143	--	--	4,358
Tamarack	8,748	--	4,372	--	--	--	--	--	--	--	4,376
Northern white-cedar	6,212	--	1,589	--	--	2,434	--	376	--	--	1,813
Other softwoods	--	--	--	--	--	--	--	--	--	--	--
Total	50,462	7,967	18,675	1,103	983	9,179	--	589	--	--	11,966
HARDWOODS:											
Select white oak	3,444	--	1,624	--	--	1,820	--	--	--	--	--
Select red oak	10,815	--	4,890	--	--	4,824	--	--	--	--	1,101
Other red oak	--	--	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--	--	--
Yellow birch	27	--	27	--	--	--	--	--	--	--	--
Hard maple	1,003	--	1,003	--	--	--	--	--	--	--	--
Soft maple	914	--	8	--	--	906	--	--	--	--	--
Ash	11,195	--	1,469	--	--	8,210	--	--	1,516	--	--
Balsam poplar	17,656	--	9,720	--	--	6,218	--	--	--	--	1,718
Paper birch	7,231	--	4,582	--	--	766	--	293	--	--	1,590
Bigtooth aspen	7,153	--	5,520	--	--	1,633	--	--	--	--	--
Quaking aspen	110,093	--	62,723	8,293	5,410	26,728	--	1,171	--	--	5,768
Basswood	5,043	--	885	--	--	4,158	--	--	--	--	--
Elm	37,957	--	37,437	--	--	--	--	--	520	--	--
Select hardwoods	--	--	--	--	--	--	--	--	--	--	--
Other hardwoods	--	--	--	--	--	--	--	--	--	--	--
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--
Total	212,531	--	129,888	8,293	5,410	55,263	--	1,464	2,036	--	10,177
All species	262,993	7,967	148,563	9,396	6,393	64,442	--	2,053	2,036	--	22,143

[1/]International 1/4-inch rule.

Table 64.--Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Minnesota, 1976

Owner	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	- - - - Thousand cubic feet- - - -			- - - [1]/Thousand board feet- - - -		
National Forest	14,272	7,505	6,767	9,352	2,426	6,926
Bureau of Land Management	--	--	--	--	--	--
Indian	4,029	1,019	3,010	7,303	1,994	5,309
Miscellaneous federal	861	131	730	1,914	388	1,526
State	20,998	8,772	12,226	35,131	12,350	22,781
County and municipal	31,990	4,477	27,513	51,818	7,623	44,195
Forest industry	12,680	3,534	9,146	18,497	6,419	12,078
Farmer	36,797	4,312	32,485	94,273	10,728	83,545
Farmer owned-leased	--	--	--	--	--	--
Misc. private-corp.	6,213	1,543	4,670	16,586	3,994	12,592
Misc. private-indiv.	13,507	2,435	11,072	28,119	4,540	23,579
Misc. priv.-corp., leased	194	--	194	--	--	--
Misc. priv.-indiv., leased	--	--	--	--	--	--
11 owners	141,541	33,728	107,813	262,993	50,462	212,531

[1]/International 1/4-inch rule.

Table 65.--Output of timber products by source of material and softwoods and hardwoods, Minnesota, 1975

Product	Standard units	Total		Roundwood products				Plant byproducts	
				Growing stock		Nongrowing stock			
		No. of units	Thousand cubic feet	No. of units	Thousand cubic feet	No. of units	Thousand cubic feet	No. of units	Thousand cubic feet
PULPWOOD:									
Softwood	Standard	622,245	49,148	546,506	43,165	31,779	2,510	43,960	3,473
Hardwood	cords[1/]	736,607	58,186	591,391	46,715	81,578	6,444	63,638	5,027
Total		1,358,852	107,334	1,137,897	89,880	113,357	8,954	107,598	8,500
FUELWOOD:									
Softwood	Standard	40,966	2,828	7,551	511	9,677	655	23,738	1,662
Hardwood	cords[1/]	301,921	20,885	123,763	8,554	161,057	11,134	17,101	1,197
Total		342,887	23,713	131,314	9,065	170,734	11,789	40,839	2,859
POSTS:	Thousand								
Softwood	pieces	2,360	1,896	1,921	1,544	439	352	--	--
Hardwood		421	403	270	255	151	148	--	--
Total		2,781	2,299	2,191	1,799	590	500	--	--
VENEER LOGS:									
Softwood	[2/]Thousand	--	--	--	--	--	--	--	--
Hardwood	board feet	3,216	503	2,946	460	270	43	--	--
Total		3,216	503	2,946	460	270	43	--	--
POLES									
Softwood	Pieces	103,405	618	102,067	610	1,338	8	--	--
Hardwood		--	--	--	--	--	--	--	--
Total		103,405	618	102,067	610	1,338	8	--	--
SAW LOGS:									
Softwood	[2/]Thousand	60,923	11,261	59,144	10,932	1,779	329	--	--
Hardwood	board feet	95,200	16,972	92,917	16,566	2,283	406	--	--
Total		156,123	28,233	152,061	27,498	4,062	735	--	--
OTHER:[3/]									
Softwood	Thousand	416	416	188	188	2	2	226	226
Hardwood	cubic feet	6,745	6,745	5,535	5,535	393	393	817	817
Total		7,161	7,161	5,723	5,723	395	395	1,043	1,043
ALL PRODUCTS:									
Softwood	Thousand	66,167	66,167	56,950	56,950	3,856	3,856	5,361	5,361
Hardwood	cubic feet	103,694	103,694	78,085	78,085	18,568	18,568	7,041	7,041
Total		169,861	169,861	135,035	135,035	22,424	22,424	12,402	12,402

[1/]Rough-wood, 128 cubic foot basis.

[2/]International 1/4-inch rule.

[3/]Other (industrial production) includes match bolts, shaving bolts, particleboard bolts, lath bolts, piling, etc.

Table 66.--Output of roundwood products by source and softwoods and hardwoods, Minnesota, 1975

(In thousand cubic feet)

Product and species group	All sources	INDUSTRIAL PRODUCTS Growing-stock trees Total	Sawtimber	Poletimber	Rough and rotten trees	Salvable dead trees	Other sources
Saw logs:							
Softwood	11,261	10,932	10,659	273	10	--	319
Hardwood	16,972	16,566	14,519	2,047	188	--	218
Subtotal	28,233	27,498	25,178	2,320	198	--	537
Veneer logs and bolts:							
Softwood	--	--	--	--	--	--	--
Hardwood	503	460	460	--	43	--	--
Subtotal	503	460	460	--	43	--	--
Pulpwood:							
Softwood	45,675	43,165	27,609	15,556	446	37	2,027
Hardwood	53,159	46,715	26,549	20,166	4,600	983	861
Subtotal	98,834	89,880	54,158	35,722	5,046	1,020	2,888
Cooperage:							
Softwood	--	--	--	--	--	--	--
Hardwood	128	110	110	--	11	--	7
Subtotal	128	110	110	--	11	--	7
Piling:							
Softwood	86	86	74	12	--	--	--
Hardwood	--	--	--	--	--	--	--
Subtotal	86	86	74	12	--	--	--
Poles:							
Softwood	618	610	570	40	8	--	--
Hardwood	--	--	--	--	--	--	--
Subtotal	618	610	570	40	8	--	--
Mine timbers (Round):							
Softwood	--	--	--	--	--	--	--
Hardwood	--	--	--	--	--	--	--
Subtotal	--	--	--	--	--	--	--
Posts (Round and split):							
Softwood	1,896	1,544	347	1,197	233	59	60
Hardwood	403	255	113	142	74	--	74
Subtotal	2,299	1,799	460	1,339	307	59	134
Other:							
Softwood	104	102	92	10	--	--	2
Hardwood	5,800	5,425	4,222	1,203	230	51	94
Subtotal	5,904	5,527	4,314	1,213	230	51	96
All industrial products:							
Softwood	59,640	56,439	39,351	17,088	697	96	2,408
Hardwood	76,965	69,531	45,973	23,558	5,146	1,034	1,254
Total	136,605	125,970	85,324	40,646	5,843	1,130	3,662
			FUELWOOD				
Softwood	1,166	511	166	345	45	63	547
Hardwood	19,688	8,554	2,786	5,768	831	1,137	9,166
Total	20,854	9,065	2,952	6,113	876	1,200	9,713
			ALL PRODUCTS				
Softwood	60,806	56,950	39,517	17,433	742	159	2,955
Hardwood	96,653	78,085	48,759	29,326	5,977	2,171	10,420
Total	157,459	135,035	88,276	46,759	6,719	2,330	13,375

Table 67.--Forest products harvested by ownership class and product, Minnesota, 1975

Ownership class	Pulpwood	Saw logs	Fuelwood	Posts	Poles	Other
	[1/] Cords	[2/] Thousand board feet	[1/] Cords	Thousand pieces	Pieces	Thousand cubic feet
FEDERAL						
National Forest:						
Softwoods	78,181	9,212	3,439	--	700	27
Hardwoods	70,625	3,684	34,096	--	--	1,004
Subtotal	148,806	12,896	37,535	--	700	1,031
Other Federal:						
Softwoods	24,320	2,538	165	108	4,700	3
Hardwoods	15,887	2,972	1,995	--	--	38
Subtotal	40,207	5,510	2,160	108	4,700	41
Total	189,013	18,406	39,695	108	5,400	1,072
STATE						
Softwoods	172,785	23,420	710	715	29,142	33
Hardwoods	122,153	17,275	7,001	2	--	508
Total	294,938	40,695	7,711	717	29,142	541
COUNTY						
Hardwoods	122,470	9,608	8,713	--	--	1,016
Total	178,320	14,843	9,374	80	485	1,029
PRIVATE						
Forest industry:						
Softwoods	86,840	2,581	153	341	--	16
Hardwoods	85,748	3,192	499	--	--	350
Subtotal	172,588	5,773	652	341	--	366
Farm and other:						
Softwoods	160,309	17,937	12,100	1,116	68,378	98
Hardwoods	256,086	58,469	232,516	419	--	3,515
Subtotal	416,395	76,406	244,616	1,535	68,378	3,613
Total	588,983	82,179	245,268	1,876	68,378	3,979
ALL OWNERS						
Softwoods	578,285	60,923	17,228	2,360	103,405	190
Hardwoods	672,969	95,200	284,820	421	--	6,431
Total	1,251,254	156,123	302,048	2,781	103,405	6,621

[1/] Rough-wood, 128 cubic foot basis.

[2/] International 1/4-inch rule.

Table 68.--Timber products from roundwood by species group and product, Minnesota, 1975

Species	All Products	Saw logs		Veneer logs		Pulpwood	
	1/Thousand cubic feet	2/Thousand board feet	1/Thousand cubic feet	2/Thousand board feet	Thousand cubic feet	Thousand cords	1/Thousand cubic feet
SOFTWOODS:							
White pine	2,541	11,272	1,943	--	--	7,386	584
Red pine	3,519	10,680	1,840	--	--	10,790	850
Jack pine	21,922	29,058	5,579	--	--	180,543	14,260
Spruce	16566	3,145	605	--	--	202,004	15,956
Balsam fir	10,073	2,100	400	--	--	121,296	9,583
Tamarack	4,620	79	14	--	--	56,266	4,442
Northern white-cedar	1,565	4,589	880	--	--	--	--
Total	60,806	60,923	11,261	--	--	578,285	45,675
HARDWOODS:							
White oak	2,498	4,187	695	29	3	--	--
Red oak	7,917	14,355	2,404	751	118	9,703	769
Hickory	29	78	13	--	--	--	--
Yellow birch	23	--	--	20	3	3	--
Hard maple	747	934	153	290	45	200	13
Soft maple	546	781	130	168	25	79	3
Ash	2,639	3,954	683	17	2	55	5
Balsam poplar	1,210	1,269	222	--	--	10,725	848
Paper birch	8,294	2,728	473	190	29	35,474	2,804
Aspen	66,831	49,501	9,166	443	72	615,995	48,660
Basswood	1,042	4,369	758	417	66	--	--
Elm	3,810	9,508	1,665	376	59	733	57
Black walnut	61	236	37	151	24	--	--
Cottonwood	778	3,196	556	358	56	--	--
Other hardwoods	228	104	17	6	1	2	--
Total	96,653	95,200	16,972	3,216	503	672,969	53,159
All species	157,459	156,123	28,233	3,216	503	1,251,254	98,834

1/Small quantities may round off to less than 500 cubic feet and will be shown as a dash in columns showing thousand cubic feet.

2/International 1/4-inch rule.

(Table 68 continued)

Species	Fuelwood		Poles		Posts		Other Products
	Cords	1/Thousand cubic feet	Pieces	1/Thousand cubic feet	Thousand pieces	1/Thousand cubic feet	1/Thousand cubic feet
SOFTWOODS:							
White pine	360	14	--	--	--	--	--
Red pine	519	27	57,284	343	523	419	40
Jack pine	12,353	865	46,121	275	1110	893	50
Spruce	125	5	--	--	--	--	--
Balsam fir	1,338	90	--	--	--	--	--
Tamarack	1,919	126	--	--	49	38	--
Northern white-cedar	614	39	--	--	678	546	100
Total	17,228	1,166	103,405	618	2,360	1,896	190
HARDWOODS:							
White oak	21,759	1,509	--	--	233	231	60
Red oak	63,515	4,436	--	--	139	140	50
Hickory	410	16	--	--	--	--	--
Yellow birch	364	20	--	--	--	--	--
Hard maple	7,820	521	--	--	--	--	15
Soft maple	5,805	388	--	--	--	--	--
Ash	28,206	1,945	--	--	11	4	--
Balsam poplar	2,101	140	--	--	3	--	--
Paper birch	61,335	4,276	--	--	--	--	712
Aspen	56,326	3,937	--	--	35	28	4,968
Basswood	2,652	149	--	--	--	--	69
Elm	28,280	1,975	--	--	--	--	54
Black walnut	--	--	--	--	--	--	--
Cottonwood	2,811	166	--	--	--	--	--
Other hardwoods	3,436	210	--	--	--	--	--
Total	284,820	19,688	--	--	421	403	5,928
All species	302,048	20,854	103,405	618	2,781	2,299	6,118

Table 69.--Volume of primary plant residue by kind of material and type of use, Minnesota, 1975

(In thousand cubic feet)

Type of use	Kind of wood residue							
	Total		Coarse[1]		Fine[2]		Bark[3]	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Fiber products[4]	1,127.1	2,968.2	1,015.1	2,797.1	112.0	171.1	--	76.6
Charcoal	57.6	216.2	57.6	216.2	--	--	35.9	100.2
Industrial fuel	1,292.9	161.4	800.7	28.1	492.2	133.3	694.1	404.5
Domestic fuel	368.4	1,034.9	354.4	851.5	14.0	183.4	167.8	423.5
Miscellaneous[5]	167.9	600.9	89.7	51.1	78.2	549.8	14.0	459.2
Not used[6]	1,430.0	2,155.8	494.0	508.1	936.0	1,647.7	1,109.7	2,136.1
Total	4,443.9	7,137.4	2,811.5	4,452.1	1,632.4	2,685.3	2,021.5	3,600.1

[1] Suitable for chipping such as slabs, edgings, veneer cores, etc.

[2] Not suitable for chipping such as sawdust, veneer clippings, etc.

[3] Does not include bark disposal at pulpmills.

[4] For manufacture of pulp, hardboard or roofing felt.

[5] Livestock bedding, mulch, small dimension, and specialty items.

[6] Includes residue burned as waste.

Table 70.--Sampling errors[1] for estimates smaller than the State totals of volume, net growth, removals, and area of commercial forest land, Minnesota, 1977

Sampling error	Commercial forest area	Growing Stock			Sawtimber		
		Inventory	Growth	Removals	Inventory	Growth	Removals
Percent	Thousand acres	- - - -Million cubic feet- - - -			- - -[2]Million board feet- - - -		
1	2,131.6	12,460.9	705.6	5,500.0	84,456.1	3,312.4	8,750.1
2	532.9	3,115.2	176.4	1,375.0	21,114.0	828.1	2,187.5
3	237.2	1,385.3	78.4	611.0	9,382.0	368.5	972.2
4	133.2	779.7	44.1	343.7	5,280.8	207.0	546.9
5	85.3	498.4	28.2	220.0	3,378.2	132.5	350.0
10	21.3	124.6	7.1	55.0	844.6	33.1	87.5
15	9.4	55.2	3.1	24.4	375.8	14.6	38.9
20	5.3	31.3	1.8	13.7	211.6	8.3	21.9
25	3.4	19.9	1.2	8.8	135.4	5.3	14.0
50	0.8	5.0	0.3	2.2	33.9	1.3	3.5
100	0.2	1.2	0.1	0.5	8.5	0.3	0.9

[1] At the 68-percent probability level.

[2] International 1/4-inch rule.

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Jakes, Pamela J.

1980. Minnesta forest statistics, 1977. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-53, 85 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

Presents highlights and statistics from the Fourth Minnesota Forest Inventory. Includes detailed tables of forest area, timber volume, net annual growth, timber removals, mortality, and timber products output.

KEY WORDS: forest inventory, forest area, timber volume, timber growth, timber removals.

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Primary Forest Products

industry and timber use, Michigan, 1977

James E. Blyth, Jack Zollner, and W. Brad Smith

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Manuscript approved for publication May 21, 1980

1981

FOREWORD

This publication contains the results of a detailed study of forest industry, industrial roundwood production, and associated logging and primary mill residues in Michigan in 1977. Such detailed information is necessary for intelligent planning and decision making in wood procurement, forest resource management, and forest industry development. Likewise, researchers need current forest industry and industrial roundwood information for planning projects.

Special thanks are given to the primary wood-using firms that supplied information for this study. Their cooperation is greatly appreciated.

Quantities shown may vary slightly from one table to another because of rounding differences, but these differences are insignificant.

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PRIMARY FOREST PRODUCTS INDUSTRY AND TIMBER USE, MICHIGAN, 1977

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HIGHLIGHTS

- Industrial roundwood production in 1977 was at ast 15 percent higher in each Inventory Unit than 1972.
- Principal softwoods cut were jack pine, balsam , and red pine; aspen constituted 43 percent of the rdwood harvest.
- One-fifth of the Michigan industrial roundwood is exported, mainly to Wisconsin.
- Overcutting (from a sustained yield basis) of pen appears likely in 1977 in many counties, rticularly in the Northern Lower Peninsula.
- Approximately 716,000 cords of residue were nerated on industrial roundwood logging opera- ns.
- Michigan produced 1.59 million cords of pulp- od, surpassed only by the production of 1974.
- Michigan loggers harvested 514 million board t of saw logs, up 13 percent from 1972.
- Aspen, hard maple, and red oak, the principal ecies cut, provided 53 percent of the saw log produc- n.
- Seven percent (20 mills) of Michigan's sawmills wed 39 percent of the lumber in 1977.
- Michigan exported 29 percent of its 42.7-million- ard foot veneer log harvest to other States and nada; two-thirds of the harvest was in the Western .
- Use of coarse mill residue for pulp and fuelwood s greatly expanded since 1975; finding customers no longer a problem.
- Additional markets for fine mill residue are eded as one-third was not used in 1977.

PRIMARY FOREST INDUSTRY—INDUSTRIAL ROUNDWOOD

Of the 320 active Michigan primary wood-using mills in 1977, 284 were sawmills. The number of active (operating) mills was nearly the same as in 1972. Twenty large sawmills, each cutting 5 million board feet of lumber or more annually, operated in 1977. More large sawmills operated than in any recorded year during the last quarter century. Log and bolt receipts at active mills (except treating plants) were 176.1 million cubic feet in 1977, up 21 percent from 1972. Both hardwood and softwood demand were high as markets were strong for products such as pallets, railroad ties, furniture, construction lumber, paper, and paperboard.

Medium to large-size primary mills are scattered throughout Michigan with the heaviest concentration in the Western Upper Peninsula (WUP) and Northern Lower Peninsula (NLP) (fig. 1).

Michigan is nearly self-sufficient in roundwood requirements; only two percent was imported—primarily softwoods from Wisconsin.

Roundwood production in 1977 was significantly higher than in 1972 in every Inventory Unit:

Unit	Production		Change
	1972	1977	
	(Thousand cubic feet)		(percent)
EUP	39,098	49,614	+27
WUP	54,931	63,340	+15
NLP	71,681	82,394	+15
SLP	18,196	20,958	+15
Total	183,906	216,308	+18

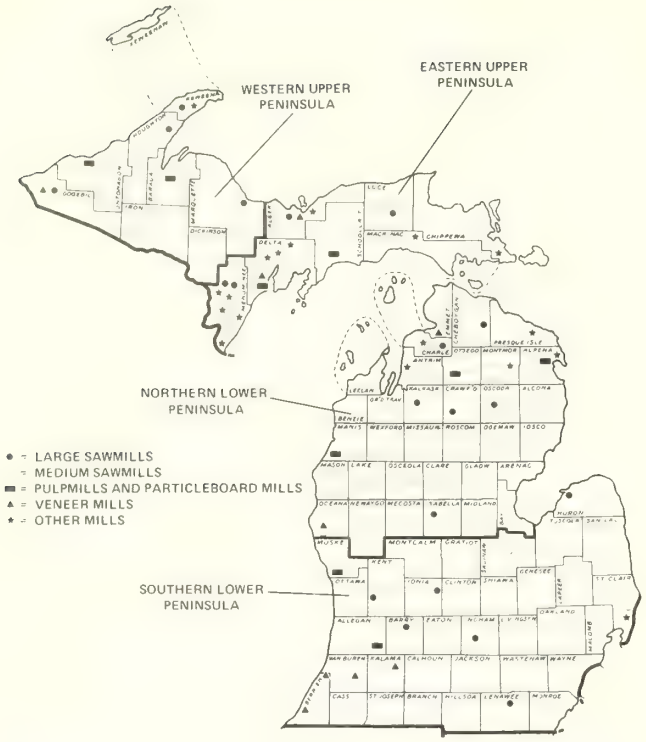


Figure 1.— *Primary wood-using mills and Inventory Units in Michigan, 1977. Sawmills are classed by volume of lumber produced in 1977: large = 5 million board feet or more; medium = 1 to 4.999 million board feet (smaller sawmills not shown). The Inventory Units are the geographical areas used by the Resources Evaluation Project to report periodic inventories and use of the Nation's forest resources.*

These were good years to compare because market demand for roundwood was similar both years. The Eastern UP timber resource appeared to be underutilized in 1972 compared to the other Units. Apparently industrial roundwood users and producers agreed since the percentage production increase in 1977 over 1972 was markedly higher in the Eastern UP than elsewhere.

Iron, Marquette, and Menominee Counties each produced more than 10 million cubic feet of industrial roundwood.

Principal softwoods harvested in 1977 were jack pine, balsam fir, and red pine. Aspen constituted 43 percent of the hardwood cut. Red oak and hard maple were other major hardwoods cut.

One-fifth of the industrial roundwood was exported; Wisconsin mills procured more than 90 percent of the exports. Overall, Michigan was a net exporter of 39.9 million cubic feet of industrial roundwood.

TIMBER REMOVALS FOR INDUSTRIAL ROUNDWOOD

Timber removals (from growing stock on commercial forest land) were an estimated 214.6 million cubic feet, a rise of 10 percent from 1972. Heaviest cutting per thousand acres of stocked commercial forest land was in Menominee, Iron, and Dickinson Counties in the UP and Ionia, Montmorency, Ceola, Clare, Kent, Barry, Lake, Eaton, and Mecosta Counties in the LP (fig. 2).

Timber removals in two major species groups—pine and aspen—were compared on a county basis with net annual growth (fig. 3). These comparisons show in a rough way where timber overcutting or undercutting (in terms of sustained yield) was possible in 1977.

These indicators of possible overutilization or underutilization of species in 1977 in specific areas of Michigan should be used cautiously in deciding future wood procurement strategy because: (1) wood procurement patterns and volumes change from year

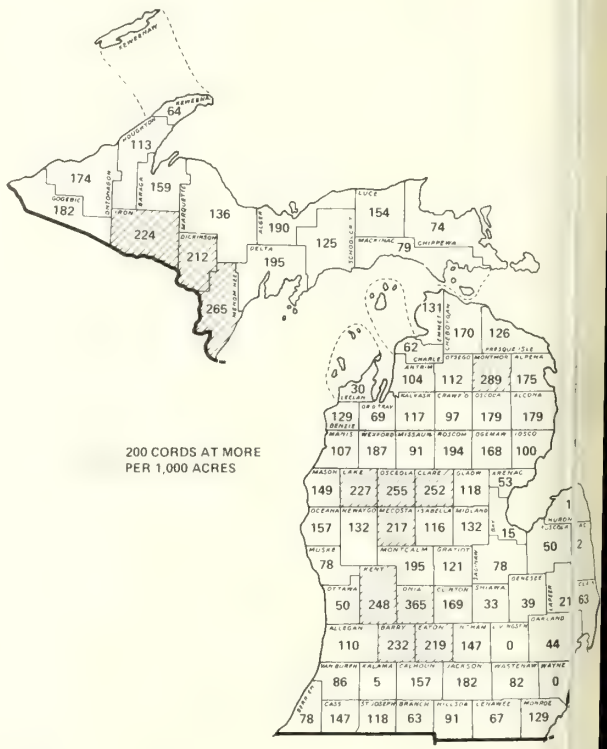


Figure 2.—*Timber removals for industrial roundwood in 1977 from growing stock on commercial forest land in Michigan counties (in cords per 1,000 acres). Acres of stocked commercial forest land were determined during the last resource inventory in Michigan.*

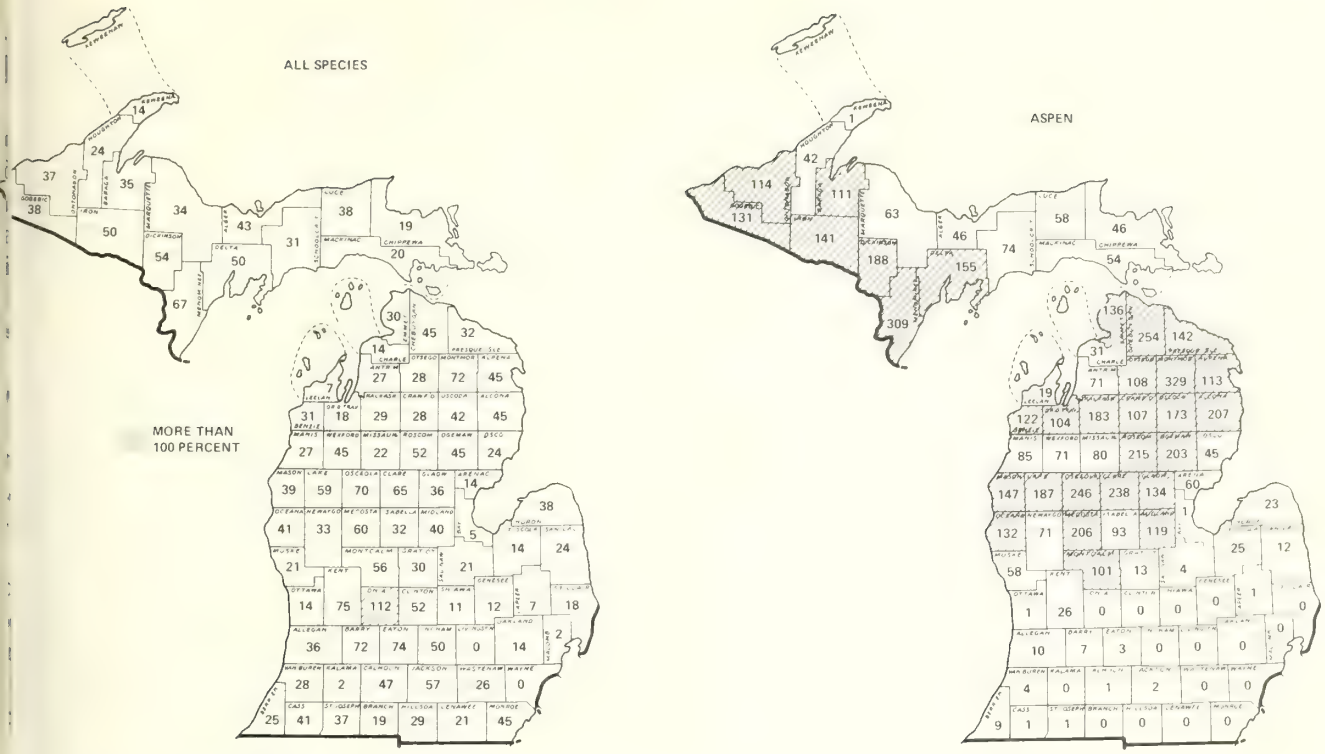
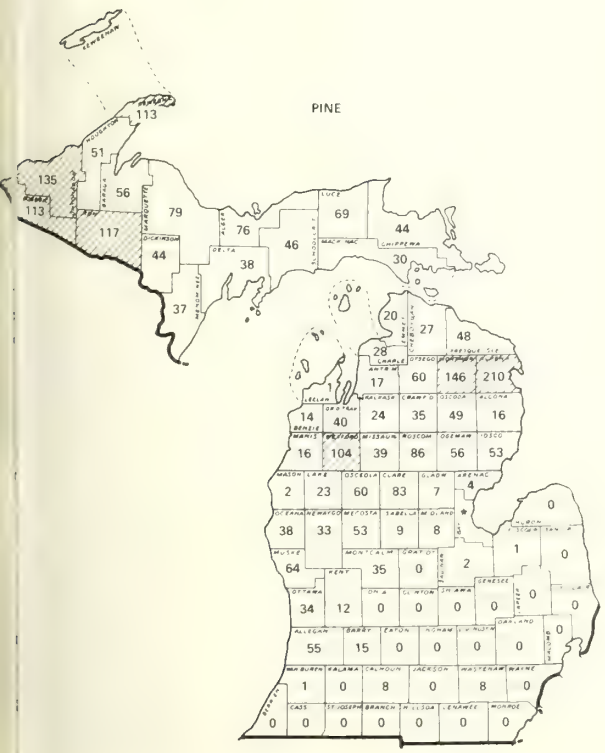


Figure 3.— *Timber removals for industrial roundwood in 1977 from growing stock on commercial forest land in Michigan counties as a percent of net annual growth (* = less than 0.5 percent). Net annual growth was determined during the last forest inventory in Michigan.*



to year, (2) net annual growth used in the comparison was for 1965, (3) stand age structure may mask the extent of under- or overutilization, and (4) apparent overcutting or undercutting may be a temporary timber management tool to improve stand structure and species mix.

Pine appears to have been overcut in 1977 in Alpena, Montmorency, and Ontonagon Counties. Underutilization of pine probably occurred in Mackinac, Crawford, Kalkaska, and Lake Counties; all have large volumes of pine growing stock.

Overcutting of aspen in 1977 seems likely in many counties, particularly in the Northern LP. Growing stock removals for industrial roundwood was more than twice the rate of 1965 net annual growth in Menominee, Cheboygan, Montmorency, Alcona, Roscommon, Ogemaw, Osceola, Clare, and Mecosta Counties. On the other hand, aspen harvesting could probably have been increased in the Eastern UP without exceeding a sustained yield.

Logging activity was greatest in the Western UP and Menominee, Delta, and Alger Counties in the Eastern UP (fig. 4).

Figure 4.— *Timber removals from growing stock on commercial forest land for industrial roundwood (to the nearest thousand standard cords, unpeeled) in Michigan counties, 1977. (* = less than 500 cords). One cord equals 79 cubic feet of solid wood fiber.*

Figure 5.— *Logging residue generated during industrial roundwood production (to the nearest 100 standard cords, unpeeled) in Michigan counties, 1977. One cord equals 79 cubic feet of solid wood fiber. (* = less than 50 cords).*

LOGGING RESIDUE

Approximately 56.6 million cubic feet (716,000 cords) of residue were generated in 1977 on Michigan industrial roundwood logging operations. Two large midwestern pulpmills or 143,000 households (each burning 5 cords of fuelwood annually for heat) could have met their wood requirements from this quantity. Much of this residue was probably not used because of its small size, small quantities available at some sites, low quality, or lack of markets. Some was undoubtedly not used because potential buyers were unaware of its availability. Six counties each had more than 30,000 cords of residue; all were in the UP (fig. 5).

More than one-fourth of the residue was aspen followed by hard maple (12 percent), jack pine (9 percent), and red oak (8 percent). Sixty-two percent of the residue was tops and limbs of growing stock trees on commercial forest land; the remainder was sawtimber growing stock (21 percent), poletimber growing stock (7 percent) and other nongrowing stock (10 percent) such as cull portions of growing stock trees and portions of cull trees, dead trees, and saplings that were cut and not used.

PULPWOOD

Michigan produced 1.59 million cords of pulpwood, surpassed only by the production of 1974. Eighty-eight of every 100 cords was roundwood (including chips from roundwood); the remainder was wood residue from sawmills, veneer mills, and other mills.

Aspen was the dominant species harvested, followed by jack pine and oak. Nearly 47,000 cords were whole-tree chips. By species group, the pulpwood from whole-tree chips was:

Species group	Quantity (Thousand standard cords)
Softwoods	2.6
Aspen	28.4
Other hardwoods	15.9

The Northern LP supplies more pulpwood than any other Unit and is the most stable area of production.

unties furnishing more than 90,000 cords each re Iron, Delta, Marquette, and Menominee.

Loggers shipped more than one-fourth of the pulpod harvest to Wisconsin mills, long-time customs for Michigan wood.

Eight Michigan pulpmills received 1.23 million ds of pulpwood; more than 90 percent was Michign wood. Michigan has always been nearly selfefficient in pulpwood requirements. Hemlock demand was the highest since 1951.

SAW LOGS

Michigan loggers cut 514 million board feet of saw gs in 1977, a 13 percent gain from 1972. More than fir-fifths was hardwood. Aspen, hard maple, and rl oak accounted for 53 percent of the saw log rvest.

Sixty million board feet were shipped out-of-State; percent was Western UP wood. Wisconsin was the rain customer followed by Indiana and Ohio. Twofths of the wood sent to Wisconsin was pine.

Aspen, hard maple, and red oak, the principal species cut, provided 53 percent of the saw log production. Aspen production increased 35 million board ft over 1972, the red oak harvest rose 21 million ard feet, and the paper birch harvest almost doubled. Yellow birch demand plummeted to less than one-fourth the 1972 level. Other significant declines from 1972 were in hard maple and hemlock.

White, red, and jack pine were the important softwoods harvested, reflecting excellent lumber demand in construction. Compared to 1972, jack pine demand more than tripled, red pine demand was up more than two and one-half times, and white pine requirements rose 80 percent.

More than half the aspen and the red oak was cut in the Northern LP, the leading saw log producing region. Gogebic, Ontonagon, Marquette, and Alger Counties, all in the UP, each furnished more than 20 million board feet of saw logs.

Although Michigan's active sawmill population was similar in 1972 and 1977, their saw log receipts expanded from 418 million board feet in 1972 to 457 million board feet in 1977. Less than 3 million board ft was procured from other States. Average lumber production per mill continues to climb.

Michigan's saw log markets and lumber production are strongly influenced by the 20 large sawmills, each producing more than 5 million board feet of lumber annually. These mills (7 percent of the total) sawed 39 percent of Michigan's lumber in 1977.

OTHER PRODUCTS

Other industrial roundwood products (8 percent of all industrial roundwood) cut in Michigan in 1977 were veneer logs, particleboard bolts, cabin logs, shingle bolts, poles, commercial posts, and piling.

Aspen was the leading veneer species cut followed by hard maple and yellow birch. Michigan exported 29 percent of its 42.7-million-board foot veneer log harvest in 1977 to other States and Canada. Wisconsin and Indiana were important customers. Three-fifths of the exports were hard maple and yellow birch.

Two-thirds of the veneer log harvest was in the Western UP with heavy cutting in Gogebic and Ontonagon Counties. Lower Peninsula loggers supplied only 13 percent of the total.

Veneer log receipts in Michigan were 30.8 million board feet. Michigan's 9 veneer mills imported only 1.5 percent of their log requirements, all from Indiana and Kentucky.

Commercial post production is concentrated in the South-central UP and Northeastern LP, particleboard bolt production in the Northern LP, and pole production in 6 UP counties and 3 Northern LP counties.

PRIMARY MILL RESIDUE

During 1977, Michigan primary wood-using mills (excluding pulp and particleboard mills) generated 637,000 green tons of coarse residue, 395,000 green tons of fine residue, and 279,000 green tons of bark. The percent of each residue class not used (piled, land fill, burned as waste, etc.) was:

Class of residue	Softwood	Hardwood
	(Percent)	
Coarse	7	5
Fine	37	34
Bark	43	29

Finding customers for coarse residue is no longer a problem. Use of coarse residue for pulp and fuelwood has greatly expanded since 1975.

Additional markets are needed for fine residue as one-third was not used in 1977. Primary uses are for soil conditioners, mulch, livestock bedding, and poultry litter. These uses have increased 80 percent since 1975. The largest quantities of fine residue not used were in the Western UP and Northern LP:

Unit	Fine Residue	
	Softwood	Hardwood
	(Thousand green tons)	
Eastern UP	5.29	9.91
Western UP	1.66	42.26
Northern LP	10.47	54.61
Southern LP	.22	11.71
Total	17.64	118.49

Similarly, the Western UP and Northern LP had the highest concentrations of bark that was not used:

Unit	Bark	
	Softwood	Hardwood
	(Thousand green tons)	
Eastern UP	3.47	4.88
Western UP	1.11	29.85
Northern LP	12.30	29.73
Southern LP	0.0	4.70
Total	16.88	69.16

Demand for bark was excellent in the Southern L where only 8 percent was not used.

OUTLOOK

Except for periods of economic downturn, indu trial roundwood production is likely to contin increasing in Michigan during the next 5 yea Another veneer mill is operating. Construction of pulpmill and waferboard plant is expected to beg by 1981.

Fine residue and bark should become more wide accepted as fuel. By 1983, most primary mill residu in economical concentrations will probably be use

APPENDIX

STUDY METHODS

Data for this publication came from a complete canvass with a formal questionnaire of primary wood-using firms that process Michigan logs and bolts. All canvassing in Michigan was done by the Michigan Department of Natural Resources (DNR) and the Michigan Regional Planning and Development Commissions (RPDC) using personal and mail contacts; follow-up on nonrespondents was by telephone and personal contact. For a few Michigan mills that did not furnish complete data, DNR wood utilization specialists provided estimates based on prior knowledge and contacts. The Michigan DNR, using similar procedures, contacted all out-of-State mills (except pulpmills) using Michigan roundwood. Similarly, the North Central Forest Experiment Station canvassed out-of-State pulpmills. The Station edited and compiled the data.

Logging utilization factors developed from a logging study by the Station in 1977-1978 were used to estimate growing stock and sawtimber removals for industrial roundwood in 1977.

DEFINITION OF TERMS

Timber removals for industrial roundwood.—The volume of sound bole wood (between a 1-foot stump and a minimum top diameter of 4.0 inches outside bark or to a point where the central stem breaks into limbs in poletimber and sawtimber growing-stock trees or commercial forest land removed annually for industrial roundwood products (including logging residues).

Sawtimber removals for industrial roundwood.—The volume of sound bole wood (between a 1-foot stump and the point on the bole above which a saw log cannot be produced) in sawtimber growing-stock trees on commercial forest land removed annually for industrial roundwood products (including logging residues). The minimum saw log top is 7.0 inches diameter outside bark for softwoods and 9.0 inches diameter outside bark for hardwoods.

Commercial forest land.—Forest land that is producing or capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. Generally, this includes

eas suitable for growing crops of industrial wood in cess of 20 cubic feet per acre annually.

Logging residue.—The unused portions of trees cut killed by logging, except roots and stumps 1 foot or ss above the ground.

Industrial roundwood products.—Saw logs, ılpwood, veneer logs, poles, commercial posts, piling, ırticleboard bolts, shaving bolts, lath bolts, charcoal ılts, and chips from roundwood.

Industrial roundwood production.—The quan-y of industrial roundwood harvested in a geographic ea.

Industrial roundwood receipts.—The quantity industrial roundwood received in a geographic area gardless of the geographic source.

Consumption.—The quantity of a commodity, such s pulpwood, utilized.

Growing-stock trees.—All live poletimber and sawtimber trees of commercial species except rough and rotten trees. Poletimber trees are 5.0 to 8.9 inches d.b.h. for softwoods and 5.0 to 10.9 inches d.b.h. for hardwoods. Softwood sawtimber trees are 9.0 inches d.b.h. or larger; hardwood sawtimber trees are 11.0 inches d.b.h. or larger.

Primary wood-using mill residue.—Wood materials (coarse and fine) and bark not utilized for principal products at manufacturing plants using roundwood. These residues include wood products (by-products) obtained incidental to production of principal products and wood materials not utilized for some product.

Coarse mill residue.—Wood residue suitable for chipping such as slabs, edgings, and veneer cores.

Fine mill residue.—Wood residue not suitable for chipping such as sawdust and veneer clippings.

OMMON AND SCIENTIFIC NAMES OF TREE SPECIES MENTIONED

OFTWOODS

astern white pine ..... *Pinus strobus*
ed pine ..... *Pinus resinosa*
ack pine ..... *Pinus banksiana*
pruce:
White spruce ..... *Picea glauca*
Black spruce ..... *Picea mariana*
alsam fir ..... *Abies balsamea*
astern hemlock ..... *Tsuga canadensis*
amarack ..... *Larix laricina*
orthern white-cedar ..... *Thuja occidentalis*

ARDWOODS

hite oak:
White oak ..... *Quercus alba*
Bur oak ..... *Quercus macrocarpa*
Chinkapin oak ..... *Quercus muehlenbergii*
Swamp white oak ..... *Quercus bicolor*
ed Oak:
Northern red oak ..... *Quercus rubra*
Black oak ..... *Quercus velutina*
Pine oak ..... *Quercus palustris*
ickory:
Bitternut hickory ..... *Carya cordiformis*
Pignut hickory ..... *Carya glabra*
Shagbark hickory ..... *Carya ovata*
Yellow birch ..... *Betula alleghaniensis*
Hard maple:
Black maple ..... *Acer nigrum*
Sugar maple ..... *Acer saccharum*
Sugar maple:
Red maple ..... *Acer rubrum*
Silver maple ..... *Acer saccharinum*
American beech ..... *Fagus grandifolia*
Ash:
Black ash ..... *Fraxinus nigra*
White ash ..... *Fraxinus americana*
Balsam poplar ..... *Populus balsamifera*
Aspen:
Bigtooth aspen ..... *Populus grandidentata*
Quaking aspen ..... *Populus tremuloides*
Eastern cottonwood ..... *Populus deltoides*
American basswood ..... *Tilia americana*
Black walnut ..... *Juglans nigra*
Elm:
American elm ..... *Ulmus americana*
Rock elm ..... *Ulmus tomasii*
Slippery elm ..... *Ulmus rubra*
Paper birch ..... *Betula papyrifera*

Table 1.--Industrial roundwood production by type of product in Michigan, 1977

Product	Standard units	All species	Soft-woods	Hard-woods	All species	Soft-woods	Hard-woods
		Thousand standard units			Thousand cubic feet		
Pulpwood	Standard cords	1,403	476	927	110,753	37,550	73,203
Saw logs	Board feet[1/]	513,956	91,497	422,459	88,604	15,925	72,679
Veneer logs	Board feet[1/]	42,738	0	42,738	5,838	0	5,838
Piling	Linear feet	42	38	4	18	15	3
Poles	Pieces	35	32	3	301	276	25
Posts[2/]	Pieces	2,966	2,966	0	3,039	3,039	0
Miscellaneous[3/]	Cubic feet	7,755	416	7,339	7,755	416	7,339
Total	Cubic feet	216,308	57,221	159,087	216,308	57,221	159,087

[1/] International 1/4-inch rule.

[2/] Includes only posts processed at fence and treating plants.

[3/] Includes cabin logs, shingle bolts, and particleboard bolts.

Table 2.--Number of active primary wood-using mills in Michigan 1954, 1965, 1969, 1972, 1975, and 1977

Kind of mill[1/]	1954	1965	1969	1972	1975	1977
Sawmills:						
Large[2/]	11	15	17	17	12	20
Medium[3/]	85	107	103	109	76	86
Small[4/]	1,296	266	187	157	174	178
Subtotal	1,392	388	307	283	262	284
Pulpmills:	11	10	9	9	8	8
Veneer mills:	23	12	12	9	8	9
Other mills:	104	27	19	23	15	19
Total	1,530	437	347	324	293	320

[1/] Number of active small sawmills estimated for 1954.

[2/] Annual lumber production in excess of 5 million board feet.

[3/] Annual lumber production from 1 million to 5 million board feet.

[4/] Annual lumber production less than 1 million board feet.

Table 3.--Industrial roundwood receipts by type of mill in Michigan, 1954, 1965, 1972, and 1977

(In million cubic feet)

Type of mill	All species				Softwoods				Hardwoods			
	1954	1965	1972	1977	1954	1965	1972	1977	1954	1965	1972	1977
Pulpmills	32.3	65.2	66.0	82.4	14.5	17.7	15.6	28.2	17.8	47.5	50.4	54.2
Sawmills	70.3	57.4	64.0	78.7	16.5	5.7	8.3	10.5	53.8	51.7	55.7	68.2
Other mills[1/]	13.1	12.5	15.7	15.0	3.6	4.9	4.2	3.4	9.5	7.6	11.5	11.6
Total	115.7	135.1	145.7	176.1	34.6	28.3	28.1	42.1	81.1	106.8	117.6	134.0

[1/] Does not include treating plants.

Table 4.--Industrial roundwood production by species, area, and county in Michigan, 19..

(In thousand cubic feet)

County	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tama-rack	Ash	Aspen	Balsam poplar	Bass-wood	Beech	White birch
EASTERN UPPER PENINSULA														
Alger	42	236	867	946	216	473	130	8	48	532	9	35	1,016	257
Chippewa	126	331	183	1,070	188	164	503	11	57	821	18	72	106	134
Delta	619	1,439	506	515	285	404	471	24	76	2,855	328	64	84	499
Luce	36	338	480	1,415	319	338	230	4	34	473	37	16	727	126
Mackinac	115	439	148	224	113	95	199	4	38	892	159	43	164	168
Menominee	1,207	1,256	263	21	109	238	548	61	257	3,844	353	99	51	390
Schoolcraft	154	423	349	961	363	296	335	8	28	915	208	12	513	221
Total	2,299	4,462	2,796	5,152	1,593	2,008	2,416	120	538	10,332	1,112	341	2,661	1,795
WESTERN UPPER PENINSULA														
Baraga	83	510	634	242	191	197	184	16	21	1,849	0	53	0	414
Dickinson	198	401	124	154	111	186	174	29	100	4,193	96	120	14	309
Gogebic	22	595	717	114	530	536	290	5	90	4,059	0	87	0	243
Houghton	48	200	315	120	199	186	291	2	57	934	0	110	0	147
Iron	54	1,224	486	355	509	619	725	32	66	4,602	55	111	0	294
Keweenaw	46	3	74	5	177	157	32	0	3	5	0	2	0	77
Marquette	116	896	708	1,708	349	742	575	17	53	1,985	289	52	177	759
Ontonagon	24	365	401	81	547	548	286	3	90	5,121	0	101	0	260
Total	591	4,194	3,459	2,779	2,613	3,171	2,557	104	480	22,748	440	636	191	2,503
NORTHERN LOWER PENINSULA														
Alcona	4	4	0	89	43	24	4	0	40	2,715	9	13	9	151
Alpena	374	268	0	670	102	3	5	0	60	857	3	10	7	102
Antrim	4	1	9	47	70	4	0	0	75	390	0	263	62	14
Arenac	0	0	0	0	16	0	0	0	4	229	0	2	0	16
Bay	0	0	0	0	0	0	0	0	7	2	0	3	0	0
Benzie	0	0	0	0	40	7	0	0	52	503	0	51	49	36
Charlevoix	0	0	2	0	89	0	0	0	2	180	0	120	4	0
Cheboygan	33	10	0	258	79	63	3	0	93	2,847	3	105	60	151
Clare	1	0	0	269	30	18	0	0	62	2,152	0	44	28	37
Crawford	0	0	0	391	115	92	0	0	10	718	0	19	13	11
Emmet	0	0	2	56	31	3	0	0	74	826	0	155	55	69
Gladwin	0	0	0	18	1	0	0	0	11	1,070	0	11	0	106
Grand Traverse	0	0	6	154	63	63	0	0	52	378	0	19	11	10
Iosco	25	0	0	902	197	107	2	0	30	345	0	3	0	2
Isabella	12	0	0	0	3	11	0	0	32	357	0	19	19	12
Kalkaska	0	1	10	300	163	46	0	0	9	1,135	0	28	26	30
Lake	0	0	0	404	11	4	0	0	59	1,599	0	55	41	11
Leelanau	0	0	5	0	2	0	0	0	25	72	0	25	37	4
Manistee	0	0	0	0	164	9	0	0	54	626	0	33	61	23
Mason	0	0	0	0	11	4	0	0	22	676	0	21	27	29
Mecosta	1	0	0	0	213	7	0	0	74	1,063	0	30	18	11
Midland	0	0	0	0	17	0	0	0	44	874	0	49	4	51
Missaukee	0	0	0	105	51	41	0	0	3	696	0	4	27	53
Montmorency	128	60	0	1,494	236	72	7	0	33	3,223	5	70	25	191
Newaygo	0	0	0	0	482	6	0	0	45	761	0	19	11	9
Oceana	0	0	11	0	256	20	0	0	53	571	0	36	62	5
Ogemaw	0	0	0	469	51	99	0	0	20	1,468	0	11	16	67
Osceola	10	0	23	3	196	35	6	0	30	1,620	0	73	55	41
Oscoda	0	7	0	1,411	266	45	3	0	16	1,537	2	4	5	68
Otsego	4	8	0	505	37	24	2	0	13	1,087	0	41	6	113
Presque Isle	218	165	3	304	12	51	10	0	22	1,386	5	58	13	206
Roscommon	0	0	0	804	46	86	0	0	0	1,686	0	16	0	51
Wexford	33	0	27	822	794	21	21	0	29	534	0	78	71	12
Total	847	524	98	9,475	3,887	965	63	0	1,155	34,183	27	1,488	822	1,692

(Table 4 continued on next page)

(Table 4 continued)

SOUTHERN LOWER PENINSULA

County	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tamarack	Ash	Aspen	Balsam poplar	Basswood	Beech	White birch
Allegan	0	0	0	92	98	11	0	0	89	37	0	5	0	0
Barry	0	0	0	0	19	0	0	0	105	12	0	57	15	0
Berrien	0	0	0	0	0	0	0	0	27	13	0	11	13	0
Branch	0	0	0	0	0	0	0	0	19	0	0	8	8	0
Calhoun	0	0	0	0	7	0	0	0	79	4	0	32	6	0
Cass	0	0	0	0	0	0	0	0	28	1	0	20	22	0
Clinton	0	0	0	0	0	0	0	0	56	0	0	19	34	0
Eaton	0	0	0	0	0	0	0	0	68	4	0	25	12	0
Genessee	0	0	0	0	0	0	0	0	10	0	0	10	0	0
Gratiot	0	0	0	0	0	0	0	0	21	48	0	18	5	0
Hillsdale	0	0	0	0	0	0	0	0	39	0	0	17	6	0
Huron	0	0	0	0	0	0	0	0	144	85	0	7	0	0
Ingham	0	0	0	0	0	0	0	0	34	0	0	37	0	0
Ionia	0	0	0	0	0	0	0	0	151	0	0	31	38	0
Jackson	0	0	0	0	0	0	0	0	75	4	0	60	6	0
Kalamazoo	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Kent	0	0	0	0	34	4	0	0	181	90	0	51	43	0
Lapeer	0	0	0	0	0	0	0	0	7	2	0	9	0	0
Lenawee	0	0	0	0	0	0	0	0	42	0	0	16	4	0
Macomb	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monroe	0	0	0	0	0	0	0	0	19	0	0	11	3	0
Montcalm	0	0	0	0	133	0	0	0	108	366	0	78	49	10
Muskegon	0	0	0	0	301	22	0	0	0	247	0	2	0	1
Oakland	0	0	0	0	0	0	0	0	61	0	0	6	0	0
Ottawa	0	0	0	0	310	2	0	0	0	1	0	0	10	0
Saginaw	0	0	0	0	3	0	0	0	65	21	0	41	0	0
St. Clair	0	0	0	0	0	0	0	0	28	0	0	10	0	0
St. Joseph	0	0	0	0	0	0	0	0	20	2	0	14	16	0
Sanilac	0	0	0	0	0	0	0	0	88	48	0	0	0	0
Shiawassee	0	0	0	0	0	0	0	0	8	0	0	8	0	0
Tuscola	0	0	0	0	1	0	0	0	42	156	0	7	0	0
Van Buren	0	0	0	0	0	2	0	0	41	8	0	10	11	0
Washtenaw	0	0	0	0	9	0	0	0	43	0	0	23	7	0
Wayne	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Total	0	0	0	92	915	41	0	0	1,699	1,149	0	645	308	11
State total	3,737	9,180	6,353	17,498	9,008	6,185	5,036	224	3,872	68,412	1,579	3,110	3,982	6,001

(Table 4 continued on next page)

County	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Walnut	Other hard-woods	All species
EASTERN UPPER PENINSULA											
Alger	317	0	275	0	1,954	589	49	0	0	21	8,020
Chippewa	35	0	78	0	449	139	25	2	0	0	4,512
Delta	132	0	500	0	749	410	20	0	0	18	9,998
Luce	146	0	94	0	1,183	339	64	0	0	2	6,401
Mackinac	24	0	156	0	389	93	15	0	0	2	3,480
Menominee	195	0	807	0	712	357	74	0	0	39	10,881
Schoolcraft	182	0	132	0	944	239	36	0	0	3	6,322
Total	1,031	0	2,042	0	6,380	2,166	283	2	0	85	49,614
WESTERN UPPER PENINSULA											
Baraga	253	0	364	0	1,525	358	21	0	0	28	6,943
Dickinson	123	0	445	0	514	231	73	0	0	22	7,617
Gogebic	173	0	281	0	894	166	6	0	0	27	8,835
Houghton	200	0	157	0	1,317	249	280	0	0	17	4,829
Iron	475	0	836	0	1,585	445	16	0	0	74	12,563
Keweenaw	25	0	10	0	185	84	149	0	0	0	1,034
Marquette	313	0	384	0	2,183	453	152	0	0	12	11,923
Ontonagon	184	0	253	0	953	342	9	0	0	28	9,596
Total	1,746	0	2,730	0	9,156	2,328	706	0	0	208	63,340
NORTHERN LOWER PENINSULA											
Alcona	0	0	0	0	40	216	1,133	169	10	1	4,674
Alpena	0	0	0	0	14	261	79	7	0	0	2,822
Antrim	0	0	123	0	208	70	37	11	0	0	1,388
Arenac	0	3	14	0	2	29	65	11	0	2	393
Bay	0	7	0	0	3	6	19	4	0	0	51
Benzie	0	0	1	0	80	248	142	7	0	21	1,237
Charlevoix	0	0	99	0	182	46	0	0	0	0	724
Cheboygan	0	0	36	0	182	485	20	1	0	0	4,429
Clare	0	24	0	3	118	417	1,220	109	0	12	4,544
Crawford	0	8	5	0	214	95	575	21	0	3	2,290
Emmet	0	0	100	0	252	132	9	4	0	0	1,768
Gladwin	0	2	0	0	61	153	235	9	0	0	1,677
Grand Traverse	0	0	1	0	20	75	13	7	0	6	878
Iosco	0	0	0	0	18	71	186	38	0	0	1,926
Isabella	0	2	9	4	16	107	210	61	0	1	875
Kalkaska	0	0	9	0	68	176	407	109	0	3	2,520
Lake	0	0	2	0	91	744	2,260	147	0	17	5,445
Leelanau	0	0	0	0	36	21	24	7	0	9	267
Manistee	0	0	5	0	78	422	354	67	0	18	1,914
Mason	0	0	1	0	93	325	606	42	0	23	1,880
Mecosta	0	3	0	2	137	165	613	98	0	4	2,429
Midland	0	137	1	0	38	224	162	48	0	0	1,649
Missaukee	0	0	24	0	27	107	373	96	0	3	1,610
Montmorency	4	0	26	0	99	279	497	78	0	13	6,540
Newaygo	0	0	0	1	75	225	1,255	332	0	8	3,229
Oceana	0	0	5	0	122	92	444	169	0	34	1,880
Ogemaw	0	0	5	0	61	111	617	125	0	7	3,127
Osceola	0	2	13	0	163	198	814	97	0	7	3,386
Oscoda	0	0	0	0	155	110	516	103	0	7	4,255
Otsego	2	0	13	0	99	76	116	23	0	13	2,182
Presque Isle	0	0	13	0	60	176	115	12	0	0	2,929
Roscommon	0	0	0	0	56	176	1,109	58	0	45	4,133
Wexford	0	0	16	0	126	399	421	29	0	12	3,445
Total	6	188	521	10	2,994	6,437	14,646	2,089	10	269	82,396

(Table 4 continued on next page)

(Table 4 continued)

SOUTHERN LOWER PENSINSULA

County	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Walnut	Other hard-woods	All species
Allegan	0	0	0	0	86	88	396	148	23	67	1,140
Barry	0	4	4	4	175	155	548	200	28	110	1,436
Berrien	2	20	0	4	46	43	112	45	0	20	356
Branch	0	9	0	2	30	28	74	44	3	1	226
Calhoun	0	5	4	5	88	166	344	197	5	80	1,022
Cass	2	5	1	14	51	54	316	157	5	19	695
Clinton	0	3	8	0	28	107	186	21	0	44	506
Eaton	0	4	11	4	87	188	252	78	4	90	827
Genessee	0	10	0	0	18	34	44	17	0	0	143
Gratiot	0	12	0	0	56	120	81	69	0	3	433
Hillsdale	0	12	0	5	38	68	149	63	8	4	409
Huron	0	60	0	0	74	88	110	56	0	0	624
Ingham	0	0	0	0	63	132	181	120	2	1	570
Ionia	0	5	8	0	194	293	573	149	0	105	1,547
Jackson	0	10	4	10	113	212	381	227	8	22	1,132
Kalamazoo	0	0	0	0	6	3	7	3	1	1	23
Kent	0	0	0	1	229	244	1,044	301	0	91	2,313
Lapeer	0	10	0	0	8	24	21	29	0	1	111
Lenawee	3	6	0	6	6	48	95	50	2	2	280
Macomb	0	0	0	0	0	0	9	14	0	0	23
Monroe	0	44	2	7	7	39	99	67	2	2	302
Montcalm	0	0	9	0	168	230	595	199	0	35	1,980
Muskegon	0	0	0	1	11	23	295	95	5	3	1,006
Oakland	0	18	0	0	15	71	141	78	0	0	390
Ottawa	0	0	0	0	3	0	13	4	0	0	343
Saginaw	0	32	0	0	42	116	123	62	0	0	505
St. Clair	0	3	0	0	24	52	97	119	0	0	333
St. Joseph	0	5	1	9	61	70	186	53	0	5	442
Sanilac	0	31	0	0	33	53	69	41	0	0	363
Shiawassee	0	8	0	0	15	18	17	17	0	0	91
Tuscola	0	32	0	0	20	28	34	29	0	4	353
Van Buren	2	12	0	1	96	51	232	96	0	8	570
Washtenaw	0	11	2	28	7	68	166	88	3	3	458
Wayne	0	1	1	1	0	0	1	1	0	0	6
Total	9	372	55	102	1,898	2,914	6,991	2,937	99	721	20,958
State total	2,792	560	5,348	112	20,428	13,845	22,626	5,028	109	1,283	216,308

Table 5.--Timber removals from growing stock on commercial forest land for industrial roundwood by species, unit, and county in Michigan, 1977

(In thousand cubic feet)

EASTERN UPPER PENINSULA

County	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tamarack	Ash	Aspen	Balsam poplar	Basswood	Beech	White birch
Alger	44	235	796	866	196	465	131	8	52	522	7	41	1,026	236
Chippewa	135	329	161	978	174	161	504	11	64	827	21	82	101	133
Delta	647	1,441	442	470	252	388	472	24	69	2,795	293	69	58	459
Luce	40	336	420	1,307	311	336	229	4	37	491	31	18	756	123
Mackinac	119	437	132	205	107	91	206	4	40	888	150	48	150	157
Menominee	1,261	1,267	237	19	99	235	548	60	233	3,800	316	111	47	374
Schoolcraft	169	421	305	885	352	289	333	8	29	894	187	15	540	203
Total	2,415	4,466	2,493	4,730	1,491	1,965	2,423	119	524	10,217	1,005	384	2,678	1,685

WESTERN UPPER PENINSULA

Baraga	84	507	568	221	168	182	184	18	20	1,813	0	55	0	432
Dickinson	208	399	111	156	110	186	176	29	93	4,128	86	137	12	288
Gogebic	22	608	659	104	530	540	305	5	100	4,318	0	99	0	266
Houghton	50	203	295	110	197	187	305	2	61	965	0	124	0	154
Iron	55	1,226	431	332	478	615	729	33	63	4,590	50	125	0	282
Keweenaw	48	3	72	6	179	159	33	0	3	6	0	2	0	87
Marquette	118	894	661	1,574	319	732	578	18	51	1,956	260	58	188	738
Ontonagon	26	379	363	78	551	552	301	3	99	5360	0	111	0	284
Total	611	4,219	3,160	2,581	2,532	3,153	2,611	108	490	23,136	396	711	200	2,531

NORTHERN LOWER PENINSULA

Alcona	5	4	0	91	44	25	4	0	35	2,699	8	12	6	139
Alpena	390	278	0	701	103	3	5	0	56	846	3	11	5	96
Antrim	4	1	9	50	71	4	0	0	85	403	0	298	67	15
Arenac	0	0	0	0	17	0	0	0	5	241	0	2	0	19
Bay	0	0	0	0	0	0	0	0	8	2	0	3	0	0
Benzie	0	0	0	0	37	7	0	0	57	495	0	55	49	31
Charlevoix	0	0	2	0	83	0	0	0	2	192	0	136	4	0
Cheboygan	38	10	0	236	70	64	3	0	88	2,858	3	117	60	140
Clare	1	0	0	251	31	19	0	0	66	2,171	0	47	19	35
Crawford	0	0	0	372	116	95	0	0	9	750	0	21	11	12
Emmet	0	0	2	52	32	3	0	0	84	856	0	176	59	68
Gladwin	0	0	0	16	1	0	0	0	12	1,087	0	12	0	106
Grand Traverse	0	0	6	142	63	63	0	0	58	371	0	21	8	9
Iosco	26	0	0	824	192	108	2	0	34	365	0	3	0	2
Isabella	12	0	0	0	3	11	0	0	36	352	0	22	21	15
Kalkaska	0	1	10	278	147	47	0	0	7	1,134	0	30	21	30
Lake	0	0	0	370	11	4	0	0	58	1,575	0	57	31	10
Leelanau	0	0	5	0	2	0	0	0	25	72	0	25	37	4
Manistee	0	0	0	0	147	9	0	0	55	625	0	35	55	20
Mason	0	0	0	0	11	4	0	0	25	670	0	24	25	26
Mecosta	1	0	0	0	186	7	0	0	81	1,059	0	34	19	10
Midland	0	0	0	0	18	0	0	0	47	908	0	55	3	55
Missaukee	0	0	0	95	45	42	0	0	3	711	0	4	29	54
Montmorency	133	62	0	1,486	235	70	7	0	34	3,225	5	79	27	179
Newaygo	0	0	0	0	420	6	0	0	50	756	0	22	8	8
Oceana	0	0	11	0	224	21	0	0	50	574	0	38	51	5
Ogemaw	0	0	0	432	52	100	0	0	20	1,540	0	12	14	72
Osceola	11	0	24	3	173	35	7	0	34	1,628	0	82	58	41
Oscoda	0	7	0	1,393	268	44	3	0	15	1,553	2	4	4	62
Otsego	4	8	0	468	35	25	2	0	15	1,099	0	47	7	106
Presque Isle	226	170	4	278	10	52	10	0	21	1,382	5	66	14	188
Roscommon	0	0	0	733	46	87	0	0	0	1,708	0	18	0	52
Wexford	34	0	28	753	699	22	22	0	31	532	0	85	73	11
Total	885	541	101	9,029	3,592	977	65	0	1,206	34,439	26	1,653	785	1,620

(Table 5 continued on next page)

(Table 5 continued)

SOUTHERN LOWER PENINSULA

County	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tamarack	Ash	Aspen	Balsam poplar	Basswood	Beech	White birch
Allegan	0	0	0	83	86	11	0	0	101	36	0	6	0	1
Barry	0	0	0	0	17	0	0	0	119	13	0	65	17	0
Berrien	0	0	0	0	0	0	0	0	31	14	0	13	15	0
Branch	0	0	0	0	0	0	0	0	22	0	0	9	9	0
Calhoun	0	0	0	0	7	0	0	0	90	4	0	37	7	0
Cass	0	0	0	0	0	0	0	0	32	1	0	23	25	0
Clinton	0	0	0	0	0	0	0	0	63	0	0	22	36	0
Eaton	0	0	0	0	0	0	0	0	77	4	0	29	13	0
Genessee	0	0	0	0	0	0	0	0	12	0	0	12	0	0
Gratiot	0	0	0	0	0	0	0	0	22	46	0	21	4	0
Hillsdale	0	0	0	0	0	0	0	0	45	0	0	19	7	0
Huron	0	0	0	0	0	0	0	0	162	91	0	8	0	0
Ingham	0	0	0	0	0	0	0	0	39	0	0	44	0	0
Ionia	0	0	0	0	0	0	0	0	171	0	0	36	40	0
Jackson	0	0	0	0	0	0	0	0	85	4	0	68	7	0
Kalamazoo	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Kent	0	0	0	0	29	4	0	0	192	90	0	58	37	0
Lapeer	0	0	0	0	0	0	0	0	8	2	0	10	0	0
Lenawee	0	0	0	0	0	0	0	0	47	0	0	18	4	0
Macomb	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monroe	0	0	0	0	0	0	0	0	22	0	0	13	3	0
Montcalm	0	0	0	0	121	0	0	0	112	366	0	89	47	11
Muskegon	0	0	0	0	262	23	0	0	0	241	0	2	0	1
Oakland	0	0	0	0	0	0	0	0	69	0	0	7	0	0
Ottawa	0	0	0	0	272	2	0	0	0	1	0	0	11	0
Saginaw	0	0	0	0	3	0	0	0	74	20	0	46	0	0
St. Clair	0	0	0	0	0	0	0	0	32	0	0	12	0	0
St. Joseph	0	0	0	0	0	0	0	0	23	2	0	16	18	0
Sanilac	0	0	0	0	0	0	0	0	100	51	0	0	0	0
Shiawassee	0	0	0	0	0	0	0	0	9	0	0	9	0	0
Tuscola	0	0	0	0	1	0	0	0	47	166	0	8	0	0
Van Buren	0	0	0	0	0	2	0	0	46	9	0	12	12	0
Washtenaw	0	0	0	0	8	0	0	0	48	0	0	27	8	0
Wayne	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	83	806	42	0	0	1,900	1,161	0	741	320	13
State total	3,911	9,226	5,754	16,423	8,421	6,137	5,099	227	4,120	68,953	1,427	3,489	3,983	5,849

(Table 5 continued on next page)

(Table 5 continued)

County	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Walnut	Other hard-woods	All species
EASTERN UPPER PENINSULA											
Alger	329	0	298	0	2,070	596	52	0	0	23	7,993
Chippewa	34	0	86	0	465	147	28	2	0	0	4,443
Delta	102	0	530	0	629	371	17	0	0	16	9,544
Luce	157	0	103	0	1,256	366	70	0	0	2	6,393
Mackinac	26	0	173	0	410	95	17	0	0	2	3,457
Menominee	171	0	807	0	616	338	75	0	0	34	10,648
Schoolcraft	190	0	140	0	983	252	38	0	0	3	6,236
Total	1,009	0	2,137	0	6,429	2,165	297	2	0	80	48,714
WESTERN UPPER PENINSULA											
Baraga	209	0	377	0	1,449	339	21	0	0	25	6,672
Dickinson	109	0	475	0	439	227	74	0	0	22	7,465
Gogebic	137	0	288	0	874	165	7	0	0	25	9,052
Houghton	184	0	156	0	1,371	266	290	0	0	15	4,935
Iron	378	0	851	0	1,372	416	15	0	0	68	12,109
Keweenaw	28	0	8	0	192	96	156	0	0	0	1,078
Marquette	291	0	407	0	2,204	440	160	0	0	11	11,658
Ontonagon	147	0	257	0	927	328	10	0	0	25	9,801
Total	1,483	0	2,819	0	8,828	2,277	733	0	0	191	62,770
NORTHERN LOWER PENINSULA											
Alcona	0	0	0	0	39	196	986	156	11	1	4,461
Alpena	0	0	0	0	11	239	70	7	0	0	2,824
Antrim	0	0	138	0	229	77	38	13	0	0	1,502
Arenac	0	4	16	0	2	33	67	13	0	2	421
Bay	0	8	0	0	3	7	20	4	0	0	55
Benzie	0	0	1	0	84	231	136	6	0	24	1,213
Charlevoix	0	0	112	0	202	52	0	0	0	0	785
Cheboygan	0	0	43	0	193	453	16	1	0	0	4,393
Clare	0	28	0	3	118	403	1,127	104	0	11	4,434
Crawford	0	9	6	0	236	87	530	21	0	3	2,278
Emmet	0	0	113	0	278	139	10	4	0	0	1,876
Gladwin	0	2	0	0	66	158	226	8	0	0	1,694
Grand Trav	0	0	1	0	19	71	13	7	0	6	858
Iosco	0	0	0	0	21	68	185	39	0	0	1,869
Isabella	0	2	10	4	14	117	194	58	0	1	872
Kalkaska	0	0	10	0	73	161	386	110	0	3	2,448
Lake	0	0	2	0	93	704	2,100	141	0	16	5,172
Leelanau	0	0	0	0	37	21	19	6	0	7	260
Manistee	0	0	6	0	75	397	318	61	0	18	1,821
Mason	0	0	1	0	100	308	557	41	0	23	1,815
Mecosta	0	4	0	2	146	182	593	88	0	5	2,417
Midland	0	156	1	0	42	232	160	49	0	0	1,726
Missaukee	0	0	28	0	30	103	348	98	0	3	1,593
Montmorency	4	0	30	0	109	263	436	73	0	15	6,472
Newaygo	0	0	0	1	77	242	1,221	328	0	9	3,148
Oceana	0	0	5	0	108	94	421	160	0	35	1,797
Ogemaw	0	0	6	0	66	113	586	119	0	6	3,140
Osceola	0	2	15	0	176	208	802	94	0	8	3,401
Oscoda	0	0	0	0	167	100	484	101	0	6	4,213
Otsego	2	0	15	0	109	68	119	24	0	15	2,168
Presque Isle	0	0	15	0	66	167	99	10	0	0	2,783
Roscommon	0	0	0	0	63	177	1,057	59	0	51	4,056
Wexford	0	0	18	0	134	364	351	26	0	11	3,194
Total	6	215	592	10	3,186	6,235	13,675	2,029	11	281	81,159

(Table 5 continued on next page)

(Table 5 continued)

SOUTHERN LOWER PENINSULA

County	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Walnut	Other hard-woods	All species
Allegan	0	0	0	0	95	101	403	153	26	76	1,178
Barry	0	5	5	4	193	175	567	206	32	124	1,542
Berrien	2	23	0	5	51	51	116	46	0	23	390
Branch	0	10	0	2	34	32	79	46	3	1	247
Calhoun	0	6	5	5	99	189	356	204	6	91	1,106
Cass	2	6	1	16	57	61	329	163	5	22	743
Clinton	0	3	9	0	31	121	192	22	0	49	548
Eaton	0	5	13	4	96	214	259	80	4	103	901
Genessee	0	12	0	0	21	39	45	19	0	0	160
Gratiot	0	14	0	0	57	130	77	67	0	3	441
Hillsdale	0	14	0	6	42	77	157	66	9	5	447
Huron	0	68	0	0	81	100	114	58	0	0	682
Ingham	0	0	0	0	69	149	186	124	2	1	614
Ionia	0	6	9	0	213	332	593	154	0	119	1,673
Jackson	0	12	5	11	124	241	394	234	9	25	1,219
Kalamazoo	0	0	0	0	7	3	8	3	1	1	25
Kent	0	0	0	1	230	255	1,034	284	0	100	2,314
Lapeer	0	12	0	0	9	28	22	30	0	1	122
Lenawee	3	7	0	7	7	54	98	52	2	2	301
Macomb	0	0	0	0	0	0	10	15	0	0	25
Monroe	0	50	2	8	8	45	101	69	2	2	325
Montcalm	0	0	10	0	170	234	552	173	0	37	1,922
Muskegon	0	0	0	1	12	26	296	96	6	3	969
Oakland	0	21	0	0	17	81	145	80	0	0	420
Ottawa	0	0	0	0	3	0	15	4	0	0	308
Saginaw	0	37	0	0	46	132	128	66	0	0	552
St. Clair	0	4	0	0	26	59	99	123	0	0	355
St. Joseph	0	6	1	10	66	79	193	55	0	6	475
Sanilac	0	36	0	0	36	60	71	42	0	0	396
Shiawassee	0	9	0	0	17	21	19	19	0	0	103
Tuscola	0	37	0	0	22	32	34	30	0	5	382
Van Buren	2	14	0	1	106	58	241	100	0	9	612
Washtenaw	0	13	2	31	8	77	171	92	3	3	491
Wayne	0	0	0	0	0	0	0	0	0	0	0
Total	9	430	62	112	2,053	3,256	7,104	2,975	110	811	21,988
State total	2,507	645	5,610	122	20,496	13,933	21,809	5,006	121	1,363	214,631

Table 6.--Timber removals from sawtimber on commercial forest land for industrial roundwood by species, unit, and county in Michigan, 1977

(In thousand board feet)[1/]

EASTERN UPPER PENINSULA

County	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tamarack	Ash	Aspen	Balsam poplar	Basswood	Beech	White birch
Alger	135	633	2,871	1,875	586	2,380	409	22	215	874	10	185	5,320	501
Chippewa	453	889	429	2,116	694	783	1,491	29	308	2,169	101	416	504	409
Delta	1,451	3,533	1,120	1,017	664	1,824	1,280	64	115	4,684	428	307	172	941
Luce	143	909	1,072	3,104	1,526	1,789	662	10	169	1,729	47	79	4,032	377
Mackinac	404	1,180	378	445	431	413	820	9	178	2,018	325	248	704	364
Menominee	3,031	2,780	734	42	315	1,208	1,501	163	401	7,612	462	555	211	1,007
Schoolcraft	535	1,140	784	2,053	1,628	1,454	909	23	101	1,465	273	73	2,921	419
Total	6,152	11,064	7,388	10,652	5,844	9,851	7,072	320	1,487	20,551	1,646	1,863	13,864	4,018

WESTERN UPPER PENINSULA

Baraga	239	1,368	1,774	478	425	637	526	47	48	3,148	0	200	0	1,707
Dickinson	665	1,074	346	610	569	1,031	508	78	189	7,680	126	680	55	686
Gogebic	59	2,203	2,415	225	2,869	3,006	1,389	14	532	19,343	0	523	0	1,227
Houghton	215	688	1,204	238	999	1,033	1,386	5	288	3,443	1	659	0	616
Iron	147	3,445	1,264	855	1,873	3,274	2,172	88	154	10,752	72	620	0	735
Keweenaw	203	6	373	13	1,022	913	151	0	7	20	0	14	0	442
Marquette	349	2,408	2,663	3,625	1,078	3,775	1,671	48	119	3,752	379	287	1,035	2,104
Ontonagon	102	1,590	1,202	253	3,046	3,131	1,402	7	481	21,144	0	536	0	1,351
Total	1,979	12,782	11,241	6,297	11,881	16,800	9,205	287	1,818	69,282	578	3,519	1,090	8,868

NORTHERN LOWER PENINSULA

Alcona	7	20	0	382	251	147	20	0	63	6,017	11	38	25	232
Alpena	588	390	0	3,270	584	20	23	0	103	1,750	4	38	14	208
Antrim	14	5	53	240	405	25	2	0	435	1,406	0	1,542	367	65
Arenac	0	0	0	0	98	0	0	0	27	1,012	0	11	0	77
Bay	0	0	0	0	0	0	0	0	44	14	0	17	0	0
Benzie	0	0	0	0	138	42	0	0	236	936	0	232	254	46
Charlevoix	0	0	14	0	327	0	0	0	10	844	0	730	22	0
Cheboygan	118	30	0	512	194	367	11	0	210	7,255	4	596	307	265
Clare	1	0	0	598	178	107	0	0	251	5,877	0	187	55	76
Crawford	0	0	0	1,099	642	532	0	0	15	2,870	0	95	47	39
Emmet	0	0	14	112	172	7	0	0	431	3,113	0	936	326	213
Gladwin	0	0	0	36	5	0	0	0	56	3,253	0	56	1	319
Grand Traverse	0	0	39	306	365	365	0	0	291	648	0	97	31	13
Iosco	128	0	0	1,788	932	615	8	0	168	1,486	0	5	0	2
Isabella	15	0	0	0	6	67	0	0	178	654	0	110	118	67
Kalkaska	0	2	60	667	485	259	0	0	11	2,653	0	114	85	86
Lake	0	0	0	801	67	21	0	0	188	2,993	0	183	109	13
Leelanau	0	0	30	0	14	1	0	0	76	137	0	76	192	6
Manistee	0	0	0	0	458	57	0	0	203	1,481	0	121	258	31
Mason	0	0	0	0	56	21	0	0	118	1,372	0	109	125	40
Mecosta	3	0	0	0	465	40	0	0	388	2,377	0	167	97	22
Midland	0	0	0	0	106	0	0	0	223	3,373	0	260	7	228
Missaukee	1	1	3	211	113	235	0	0	7	2,173	0	10	149	182
Montmorency	205	115	0	5,590	1,280	371	21	0	114	7,824	7	429	145	409
Newaygo	0	0	0	0	1,051	35	0	0	227	1,655	0	110	37	11
Oceana	1	0	66	0	568	124	0	0	136	1,526	0	161	221	7
Ogemaw	0	0	0	995	288	574	0	0	68	6,144	0	56	65	306
Osceola	54	0	140	18	484	200	35	0	167	4,212	0	412	305	135
Oscoda	7	31	0	5,042	1,486	229	6	0	21	4,237	2	9	10	113
Otsego	14	25	0	1,105	155	123	9	0	76	2,996	0	273	35	247
Presque Isle	323	304	10	603	26	283	28	0	53	3,180	2	354	78	342
Roscommon	1	1	3	1,687	244	505	0	0	2	4,867	0	95	2	188
Wexford	162	1	167	1,660	1,869	120	108	0	127	1,206	0	412	390	17
Total	1,625	915	599	26,722	13,512	5,492	271	0	4,723	91,531	35	8,041	3,877	4,005

(Table 6 continued on next page)

(Table 6 continued)

SOUTHERN LOWER PENINSULA

County	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tama-rack	Ash	Aspen	Balsam poplar	Bass-wood	Beech	White birch
Allegan	0	0	0	180	216	65	0	0	520	70	0	31	0	1
Barry	0	0	0	0	42	0	0	0	610	47	0	331	97	0
Berrien	0	0	0	0	0	0	0	0	163	68	0	68	84	0
Branch	0	0	0	0	0	0	0	0	113	1	0	47	52	0
Calhoun	0	0	0	0	17	0	0	0	460	18	0	197	39	0
Cass	0	0	0	0	0	0	0	0	164	3	0	114	141	0
Clinton	0	0	0	0	0	0	0	0	325	0	0	110	194	0
Eaton	0	0	0	0	0	0	0	0	392	18	0	148	78	0
Genessee	0	0	0	0	0	0	0	0	61	1	0	62	0	0
Gratiot	0	0	0	0	0	0	0	0	75	82	0	104	11	0
Hillsdale	0	0	0	0	0	0	0	0	229	0	0	97	35	0
Huron	0	0	0	0	0	0	0	0	832	416	0	41	0	0
Ingham	0	0	0	0	0	0	0	0	205	3	0	223	3	0
Ionia	0	0	0	0	0	0	0	0	876	0	0	185	222	0
Jackson	0	0	0	0	0	0	0	0	437	18	0	352	39	0
Kalamazoo	0	0	0	0	0	0	0	0	0	0	0	10	0	0
Kent	0	0	0	0	89	23	0	0	802	195	0	292	164	0
Lapeer	0	0	0	0	0	0	0	0	43	13	0	55	0	0
Lenawee	0	0	0	0	0	0	0	0	239	0	0	91	25	0
Macomb	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monroe	0	0	0	0	0	0	0	0	113	0	0	68	18	0
Montcalm	0	0	0	0	417	0	0	0	450	839	0	454	228	60
Muskegon	0	0	0	0	653	135	0	0	3	390	0	14	1	2
Oakland	0	0	0	0	0	0	0	0	358	0	0	35	0	0
Ottawa	0	0	0	0	680	13	0	0	0	2	0	3	65	0
Saginaw	0	0	0	0	9	0	0	0	378	53	0	237	0	0
St.Clair	0	0	0	0	0	0	0	0	166	0	0	61	0	0
St.Joseph	0	0	0	0	0	0	0	0	115	11	0	82	99	0
Sanilac	0	0	0	0	0	0	0	0	514	233	0	0	0	0
Shiawassee	0	0	0	0	0	0	0	0	51	0	0	51	0	0
Tuscola	0	0	0	0	7	0	0	0	239	761	0	44	0	0
Van Buren	0	0	0	0	0	12	0	0	237	42	0	64	70	0
Washtenaw	0	0	0	0	19	0	0	0	249	0	0	137	44	0
Wayne	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	180	2,149	248	0	0	9,419	3,284	0	3,808	1,709	63
State total	9,766	24,761	19,228	43,851	33,386	32,391	16,548	607	17,447	184,648	2,259	17,231	20,540	16,954

(Table 6 continued on next page)

(Table 6 continued)

County	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Walnut	Other hard-woods	All species
EASTERN UPPER PENINSULA											
Alger	1,972	0	1,375	0	11,622	2,079	293	0	0	100	33,457
Chippewa	189	0	413	0	2,490	562	153	11	0	3	14,617
Delta	397	0	2,195	0	2,679	603	20	0	0	41	23,535
Luce	998	0	481	0	7,006	1,589	413	0	0	4	26,139
Mackinac	161	0	838	0	2,257	297	103	0	0	5	11,578
Menominee	780	0	2,665	0	2,712	800	361	0	0	53	27,393
Schoolcraft	1,161	0	591	0	5,445	1,021	185	0	0	7	22,188
Total	5,658	0	8,563	0	34,211	6,951	1,528	11	0	213	158,907
WESTERN UPPER PENINSULA											
Baraga	919	0	1,437	0	7,206	819	80	0	0	39	21,097
Dickinson	509	0	2,055	0	1,909	655	351	0	0	72	19,848
Gogebic	579	0	1,060	0	4,519	532	36	0	0	50	40,581
Houghton	922	0	504	0	7,430	1,132	1,505	0	0	24	22,292
Iron	1,505	0	3,063	0	6,059	940	51	0	0	119	37,188
Keweenaw	189	0	13	0	1,038	469	836	0	0	2	5,716
Marquette	1,509	0	1,667	0	11,654	1,285	853	0	0	19	40,280
Ontonagon	634	0	902	0	4,777	848	54	0	0	51	41,511
Total	6,766	0	10,706	0	44,592	6,680	3,766	0	0	376	228,513
NORTHERN LOWER PENINSULA											
Alcona	0	0	0	0	198	326	1,673	461	60	2	9,933
Alpena	0	0	0	0	37	441	156	4	0	0	7,630
Antrim	0	0	707	0	1,334	361	198	66	0	0	7,225
Arenac	0	20	82	0	11	158	348	66	0	16	1,926
Bay	0	42	0	0	17	34	104	24	0	0	296
Benzie	0	0	9	0	467	511	485	3	0	107	3,466
Charlevoix	0	0	572	0	1,177	262	0	0	0	0	3,958
Cheboygan	0	0	217	0	1,085	997	18	1	0	0	12,137
Clare	0	143	0	19	609	1,139	3,340	383	0	16	12,979
Crawford	0	65	29	0	1,327	148	1,523	63	0	7	3,501
Emmet	0	0	582	0	1,617	568	51	25	0	0	8,167
Gladwin	0	15	2	0	377	589	851	13	0	0	5,573
Grand Traverse	0	0	9	0	96	159	36	17	0	21	2,493
Iosco	0	0	0	0	117	157	812	185	0	0	6,403
Isabella	0	10	58	25	72	529	596	223	0	4	2,732
Kalkaska	0	0	57	0	401	271	1,370	504	0	5	7,030
Lake	0	0	10	3	489	1,698	6,535	521	0	60	13,691
Leelanau	0	0	0	0	191	50	10	3	0	11	797
Manistee	0	0	30	0	370	920	735	185	0	65	4,914
Mason	0	0	7	1	549	746	1,563	182	0	87	4,976
Mecosta	0	20	0	12	815	845	2,362	409	0	24	3,046
Midland	0	796	5	0	240	893	707	259	0	0	7,097
Missaukee	0	0	143	0	171	232	1,101	458	0	5	5,195
Montmorency	23	0	153	0	644	590	769	256	0	76	19,021
Newaygo	0	0	0	8	412	1,070	4,924	1,398	0	43	10,981
Oceana	0	0	31	0	500	385	1,462	562	0	146	5,896
Ogemaw	0	0	30	0	375	378	2,090	428	0	30	11,927
Osceola	0	10	76	1	982	858	3,427	383	0	43	11,942
Oscoda	2	0	0	0	937	145	1,575	439	0	9	14,283
Otsego	15	0	76	0	656	99	575	123	0	76	6,678
Presque Isle	0	0	76	0	392	444	127	5	0	0	6,635
Roscommon	1	0	0	0	355	598	3,759	286	0	259	12,843
Wexford	0	0	90	0	739	633	242	40	0	23	8,006
Total	41	1,121	3,051	69	17,759	17,234	43,524	7,975	60	1,135	253,327

(Table 6 continued on next page)

(Table 6 continued)

SOUTHERN LOWER PENINSULA

County	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Walnut	Other hard-woods	All species
Allegan	0	0	0	3	546	497	1,978	773	185	391	5,456
Barry	0	23	23	24	1,111	897	2,953	1,080	223	642	8,103
Berrien	13	141	1	30	305	272	607	239	0	124	2,115
Branch	0	56	0	14	191	170	429	250	20	7	1,350
Calhoun	0	30	23	30	559	969	1,859	1,090	39	471	5,801
Cass	14	29	6	88	332	313	1,768	869	29	115	3,985
Clinton	0	18	47	0	176	621	997	111	5	251	2,855
Eaton	0	24	70	22	556	1,099	1,346	416	27	525	4,721
Genessee	0	64	0	0	121	204	235	94	0	0	842
Gratiot	0	71	0	0	307	594	321	301	0	4	1,870
Hillsdale	0	71	0	32	243	396	881	358	55	28	2,425
Huron	0	349	0	0	458	512	593	305	0	0	3,506
Ingham	0	0	0	0	390	767	966	646	11	10	3,224
Ionia	0	33	47	1	1,219	1,702	3,083	798	2	614	8,782
Jackson	0	64	23	62	709	1,232	2,049	1,230	51	130	6,396
Kalamazoo	0	0	0	2	39	18	52	21	7	11	160
Kent	0	0	0	11	1,203	1,005	4,556	991	3	460	9,794
Lapeer	0	64	0	0	51	144	115	153	0	9	647
Lenawee	21	40	0	39	37	274	508	267	12	12	1,565
Macomb	0	0	0	0	0	0	52	78	0	0	130
Monroe	0	255	14	43	48	226	526	355	10	10	1,686
Montcalm	0	0	58	4	906	849	1,730	303	3	140	6,441
Muskegon	0	0	0	7	71	115	1,374	464	42	21	3,292
Oakland	0	102	0	0	101	413	752	420	0	0	2,181
Ottawa	0	0	0	1	21	0	85	29	1	2	902
Saginaw	0	194	0	0	263	673	637	369	0	0	2,813
St. Clair	0	21	0	0	152	299	513	641	0	0	1,853
St. Joseph	0	29	4	55	374	429	1,032	284	0	31	2,545
Sanilac	0	185	0	0	202	309	369	215	0	0	2,027
Shiawassee	0	51	0	0	101	102	94	94	0	0	544
Tuscola	0	194	0	0	128	170	179	154	0	23	1,899
Van Buren	14	78	3	9	599	297	1,286	527	2	48	3,288
Washtenaw	0	67	14	172	45	395	892	475	19	19	2,547
Wayne	0	0	0	0	0	0	0	0	0	0	0
Total	62	2,253	333	649	11,564	15,963	34,817	14,400	746	4,098	105,745
State total	12,527	3,374	22,653	718	108,126	46,828	83,635	22,386	806	5,822	746,492

1/ International 1/4-inch rule.

Table 7.--Logging residue generated during industrial roundwood production by species, unit, and county in Michigan, 1977

(In thousand cubic feet)

EASTERN UPPER PENINSULA

County	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tamarack	Ash	Aspen	Balsam poplar	Basswood	Beech	White birch
Alger	14	69	286	256	69	156	40	2	13	114	1	11	318	54
Chippewa	39	94	61	287	61	55	154	3	17	189	6	22	35	33
Delta	120	381	167	137	88	132	136	7	16	606	68	18	34	106
Luce	12	97	159	397	102	111	68	1	10	118	7	4	221	28
Mackinac	37	127	49	60	38	31	75	1	9	197	37	13	54	38
Menominee	267	300	87	5	33	79	159	17	57	841	75	29	19	89
Schoolcraft	27	121	116	265	112	96	95	2	8	193	45	4	155	46
Total	516	1,189	925	1,407	503	660	727	33	130	2,258	239	101	836	394

WESTERN UPPER PENINSULA

Baraga	25	147	210	65	65	60	54	6	3	396	0	14	0	110
Dickinson	60	117	42	60	36	60	53	8	21	905	19	37	6	66
Gogebic	6	211	237	31	175	177	123	1	24	908	0	25	0	68
Houghton	18	68	104	32	67	61	122	0	15	230	0	31	0	39
Iron	16	367	160	103	168	204	225	10	16	994	12	33	0	70
Keweenaw	5	1	23	3	58	51	13	0	0	2	0	0	0	22
Marquette	36	260	234	474	110	243	175	5	12	430	63	14	50	181
Ontonagon	9	144	133	27	181	179	123	1	25	1136	0	26	0	74
Total	175	1,315	1,143	795	860	1,035	888	31	116	5,001	94	180	56	630

NORTHERN LOWER PENINSULA

Alcona	1	1	0	35	14	8	1	0	8	603	2	3	3	33
Alpena	56	42	0	290	33	1	1	0	14	186	0	3	4	24
Antrim	0	0	3	21	23	1	0	0	22	97	0	76	18	3
Arenac	0	0	0	0	6	0	0	0	1	59	0	0	0	5
Bay	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Benzie	0	0	0	0	13	2	0	0	14	109	0	13	15	7
Charlevoix	0	0	1	0	28	0	0	0	0	48	0	34	0	0
Cheboygan	5	3	0	69	26	21	1	0	21	652	0	28	19	34
Clare	0	0	0	77	11	6	0	0	17	499	0	11	10	9
Crawford	0	0	0	123	37	31	0	0	2	183	0	6	5	3
Emmet	0	0	1	16	11	1	0	0	22	206	0	46	16	17
Gladwin	0	0	0	4	0	0	0	0	3	253	0	3	0	26
Grand Traverse	0	0	2	43	20	20	0	0	16	80	0	6	3	2
Iosco	12	0	0	242	65	34	1	0	9	91	0	1	0	0
Isabella	1	0	0	0	1	3	0	0	8	77	0	6	5	4
Kalkaska	0	0	3	86	54	15	0	0	1	256	0	8	10	6
Lake	0	0	0	109	3	1	0	0	14	347	0	15	16	2
Leelanau	0	0	1	0	1	0	0	0	5	16	0	5	12	1
Manistee	0	0	0	0	54	3	0	0	13	142	0	9	20	5
Mason	0	0	0	0	3	1	0	0	7	148	0	7	8	6
Mecosta	0	0	0	0	71	2	0	0	20	237	0	9	6	2
Midland	0	0	0	0	6	0	0	0	11	219	0	15	1	13
Missaukee	0	0	0	28	17	13	0	0	1	167	0	1	8	13
Montmorency	20	13	0	551	77	23	2	0	8	730	1	18	8	43
Newaygo	0	0	0	0	160	2	0	0	13	169	0	6	2	2
Oceana	0	0	3	0	85	7	0	0	11	128	0	7	21	1
Ogemaw	0	0	0	129	15	33	0	0	4	379	0	3	6	18
Osceola	4	0	8	1	60	11	3	0	8	371	0	21	17	11
Oscoda	0	2	0	506	88	13	1	0	3	358	0	0	1	15
Otsego	0	2	0	143	13	8	0	0	3	254	0	10	2	25
Presque Isle	31	32	2	82	4	17	3	0	4	305	1	16	3	45
Roscommon	0	0	0	221	11	27	0	0	0	395	0	5	0	13
Wexford	14	0	9	222	263	7	9	0	8	119	0	22	21	3
Total	144	95	33	2,998	1,273	311	22	0	293	7,883	4	413	260	391

(Table 7 continued on next page)

(Table 7 continued)

SOUTHERN LOWER PENINSULA

County	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tama-rack	Ash	Aspen	Balsam poplar	Bass-wood	Beech	White birch
Allegan	0	0	0	25	30	3	0	0	27	8	0	2	0	1
Barry	0	0	0	0	7	0	0	0	32	3	0	17	5	0
Berrien	0	0	0	0	0	0	0	0	8	3	0	3	4	0
Branch	0	0	0	0	0	0	0	0	6	0	0	2	3	0
Calhoun	0	0	0	0	2	0	0	0	24	1	0	9	2	0
Cass	0	0	0	0	0	0	0	0	8	0	0	6	7	0
Clinton	0	0	0	0	0	0	0	0	16	0	0	6	9	0
Eaton	0	0	0	0	0	0	0	0	21	1	0	8	3	0
Genessee	0	0	0	0	0	0	0	0	3	0	0	3	0	0
Gratiot	0	0	0	0	0	0	0	0	5	9	0	6	1	0
Hillsdale	0	0	0	0	0	0	0	0	11	0	0	5	2	0
Huron	0	0	0	0	0	0	0	0	42	22	0	2	0	0
Ingham	0	0	0	0	0	0	0	0	10	0	0	12	0	0
Ionia	0	0	0	0	0	0	0	0	46	0	0	10	11	0
Jackson	0	0	0	0	0	0	0	0	22	1	0	18	2	0
Kalamazoo	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kent	0	0	0	0	10	1	0	0	50	21	0	16	16	0
Lapeer	0	0	0	0	0	0	0	0	2	0	0	2	0	0
Lenawee	0	0	0	0	0	0	0	0	13	0	0	5	0	0
Macomb	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monroe	0	0	0	0	0	0	0	0	6	0	0	3	0	0
Montcalm	0	0	0	0	44	0	0	0	29	83	0	24	17	2
Muskegon	0	0	0	0	99	8	0	0	0	51	0	0	0	0
Oakland	0	0	0	0	0	0	0	0	18	0	0	2	0	0
Ottawa	0	0	0	0	101	1	0	0	0	0	0	0	3	0
Saginaw	0	0	0	0	1	0	0	0	19	3	0	13	0	0
St. Clair	0	0	0	0	0	0	0	0	8	0	0	3	0	0
St. Joseph	0	0	0	0	0	0	0	0	6	0	0	5	5	0
Sanilac	0	0	0	0	0	0	0	0	27	13	0	0	0	0
Shiawassee	0	0	0	0	0	0	0	0	2	0	0	2	0	0
Tuscola	0	0	0	0	0	0	0	0	13	42	0	2	0	0
Van Buren	0	0	0	0	0	1	0	0	13	2	0	3	3	0
Washtenaw	0	0	0	0	2	0	0	0	13	0	0	8	3	0
Wayne	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	25	296	14	0	0	500	263	0	197	96	3
State total	835	2,599	2,101	5,225	2,932	2,020	1,637	64	1,039	15,405	337	891	1,248	1,418

(Table 7 continued on next page)

County	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Walnut	Other hard-woods	All species
Alger	82	0	76	0	624	153	10	0	0	6	2,354
Chippewa	10	0	21	0	154	39	5	0	0	0	1,285
Delta	49	0	137	0	279	89	3	0	0	2	2,575
Luce	33	0	26	0	384	95	13	0	0	0	1,886
Mackinac	6	0	44	0	129	24	3	0	0	0	972
Menominee	67	0	201	0	264	82	15	0	0	8	2,694
Schoolcraft	45	0	36	0	305	65	6	0	0	1	1,743
Total	292	0	541	0	2,139	547	55	0	0	17	13,509
WESTERN UPPER PENINSULA											
Baraga	86	0	97	0	534	82	4	0	0	6	1,964
Dickinson	41	0	123	0	190	58	14	0	0	5	1,921
Gogebic	60	0	72	0	304	40	1	0	0	6	2,469
Houghton	63	0	38	0	442	69	60	0	0	2	1,461
Iron	171	0	212	0	585	98	1	0	0	16	3,461
Keweenaw	6	0	1	0	62	26	32	0	0	0	305
Marquette	97	0	104	0	742	109	31	0	0	3	3,373
Ontonagon	63	0	65	0	324	80	3	0	0	5	2,598
Total	587	0	712	0	3,183	562	146	0	0	43	17,552
NORTHERN LOWER PENINSULA											
Alcona	0	0	0	0	13	47	212	33	3	0	1,020
Alpena	0	0	0	0	7	57	14	2	0	0	734
Antrim	0	0	37	0	65	20	9	4	0	0	399
Arenac	0	1	5	0	0	9	13	4	0	0	103
Bay	0	2	0	0	0	2	4	0	0	0	10
Benzie	0	0	0	0	27	57	29	1	0	6	293
Charlevoix	0	0	30	0	56	14	0	0	0	0	211
Cheboygan	0	0	12	0	58	110	2	0	0	0	1,061
Clare	0	8	0	0	41	99	238	22	0	3	1,051
Crawford	0	1	2	0	72	20	114	6	0	0	605
Emmet	0	0	30	0	78	37	2	0	0	0	483
Gladwin	0	0	0	0	19	39	47	1	0	0	395
Grand Traverse	0	0	0	0	8	17	2	1	0	1	221
Iosco	0	0	0	0	7	17	39	9	0	0	527
Isabella	0	0	2	0	5	28	40	12	0	0	192
Kalkaska	0	0	2	0	22	38	81	23	0	1	606
Lake	0	0	0	0	32	171	443	29	0	3	1,185
Leelanau	0	0	0	0	13	5	3	1	0	1	64
Manistee	0	0	2	0	27	96	68	13	0	4	456
Mason	0	0	0	0	32	76	119	8	0	6	421
Mecosta	0	1	0	0	45	49	124	18	0	1	585
Midland	0	42	0	0	12	59	34	9	0	0	421
Missaukee	0	0	8	0	9	26	73	21	0	1	386
Montmorenc	0	0	8	0	31	64	96	15	0	3	1,711
Newaygo	0	0	0	0	26	62	256	69	0	2	769
Oceana	0	0	0	0	44	23	90	34	0	8	462
Ogemaw	0	0	2	0	19	28	123	25	0	1	785
Osceola	0	0	3	0	54	53	168	20	0	2	815
Oscoda	0	0	0	0	51	23	103	20	0	2	1,186
Otsego	0	0	3	0	29	17	24	5	0	3	541
Presque Isle	0	0	3	0	17	40	22	2	0	0	629
Roscommon	0	0	0	0	19	44	224	13	0	14	986
Wexford	0	0	5	0	41	88	77	5	0	2	915
Total	0	55	154	0	979	1,535	2,893	425	3	64	20,228

(Table 7 continued on next page)

(Table 7 continued)

SOUTHERN LOWER PENINSULA

County	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Walnut	Other hard-woods	All species
Allegan	0	0	0	0	27	28	84	33	4	19	291
Barry	0	1	1	0	55	46	118	41	5	32	363
Berrien	0	4	0	1	13	13	25	9	0	6	89
Branch	0	2	0	0	10	8	16	9	0	0	56
Calhoun	0	2	1	0	30	51	74	41	1	24	262
Cass	0	2	0	4	15	16	67	33	0	6	164
Clinton	0	0	2	0	9	32	41	4	0	13	132
Eaton	0	1	3	0	27	57	53	16	0	28	218
Genessee	0	3	0	0	7	10	9	4	0	0	39
Gratiot	0	3	0	0	18	34	15	14	0	0	105
Hillsdale	0	3	0	2	12	21	30	13	3	2	104
Huron	0	18	0	0	24	27	25	12	0	0	172
Ingham	0	0	0	0	21	40	38	25	0	0	146
Ionia	0	2	2	0	62	89	123	32	0	32	409
Jackson	0	3	1	3	36	65	82	47	3	7	290
Kalamazoo	0	0	0	0	1	0	1	0	0	0	2
Kent	0	0	0	0	79	66	215	59	0	25	558
Lapeer	0	3	0	0	2	8	4	6	0	0	27
Lenawee	0	2	0	2	2	14	20	11	0	0	69
Macomb	0	0	0	0	0	0	2	3	0	0	5
Monroe	0	14	0	3	2	11	21	14	0	0	74
Montcalm	0	0	2	0	56	60	116	38	0	9	480
Muskegon	0	0	0	0	1	7	61	19	1	0	247
Oakland	0	6	0	0	5	22	30	16	0	0	99
Ottawa	0	0	0	0	0	0	3	0	0	0	108
Saginaw	0	10	0	0	13	35	28	13	0	0	135
St. Clair	0	1	0	0	7	16	21	25	0	0	81
St. Joseph	0	2	0	3	19	19	39	12	0	2	112
Sanilac	0	10	0	0	11	16	15	9	0	0	101
Shiawassee	0	2	0	0	5	6	4	4	0	0	25
Tuscola	0	10	0	0	7	8	7	6	0	1	96
Van Buren	0	3	0	0	31	16	49	20	0	2	143
Washtenaw	0	3	0	9	2	21	35	20	0	0	116
Wayne	0	0	0	0	0	0	0	0	0	0	0
Total	0	110	12	27	609	862	1,471	608	17	208	5,318
State total	879	165	1,419	27	6,910	3,506	4,565	1,033	20	332	56,607

Table 8.--Michigan pulpwood production by species group and destination, 1977

(In thousand standard cords, unpeeled)

Species group	Destination of wood			
	Michigan	Wisconsin	Other States and Canada	Total
ROUNDWOOD:[1/]				
Jack pine	125	58	0	183
Balsam fir	45	42	8	95
Red pine	57	9	0	66
Hemlock	52	10	0	62
Spruce	22	19	7	48
Other softwoods	17	5	0	22
Aspen	369	163	0	532
Oak	107	0	0	107
Soft maple	77	12	0	89
Birch	47	15	0	62
Hard maple	32	28	0	60
Other hardwoods	50	27	0	77
Total	1,000	388	15	1,403
RESIDUE:				
Softwood	16	1	4	21
Hardwood	143	18	10	171
All material	1,159	407	29	1,595

[1/] Includes chips from roundwood.

Table 9.--Pulpwood production from roundwood by county and species, Michigan, 1977

(In thousand cords, unpeeled)

EASTERN UPPER PENINSULA

County	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tama-rack	Ash	Aspen	Balsam poplar	Bass-wood	Beech	White birch
Alger	452	2,984	7,610	11,995	2,314	1,330	1,380	105	204	6,623	94	83	2,198	2,917
Chippewa	168	4,152	2,237	13,545	1,382	602	5,601	138	76	3,497	15	16	392	692
Delta	1,023	15,185	6,329	6,509	3,348	1,853	5,764	303	927	35,443	4,146	183	1,003	5,758
Luce	215	4,247	5,985	16,677	1,108	619	2,641	50	88	2,223	454	22	879	1,084
Mackinac	829	5,525	1,693	2,763	795	467	1,017	46	116	4,201	1,699	0	810	1,458
Menominee	400	10,477	2,792	268	1,036	639	6,763	767	3,074	42,760	4,464	57	291	3,704
Schoolcraft	468	5,281	4,360	11,544	1,566	938	4,152	109	178	11,287	2,640	0	425	2,384
Total	3,555	47,851	31,006	63,301	11,549	6,448	27,318	1,518	4,663	106,034	13,512	361	5,998	17,997

WESTERN UPPER PENINSULA

Baraga	932	6,447	6,666	3,062	2,382	1,481	2,171	220	220	22,521	0	317	0	1,997
Dickinson	102	5,061	1,333	710	264	165	2,007	371	1,098	49,026	1,226	82	89	3,296
Gogebic	276	4,354	6,115	1,440	781	437	511	64	92	17,695	0	5	0	533
Houghton	107	1,729	2,212	1,525	575	168	515	25	95	4,274	8	0	0	676
Iron	687	14,727	5,431	3,875	3,717	1,186	8,020	412	625	48,357	703	73	0	2,756
Keweenaw	5	30	195	85	45	8	77	1	21	30	0	0	0	25
Marquette	852	11,252	5,091	20,645	3,271	1,907	6,620	225	540	22,753	3,670	41	36	6,543
Ontonagon	147	1,457	3,964	666	514	231	284	34	96	30,684	0	211	0	462
Total	3,108	45,057	31,007	32,008	11,549	5,583	20,205	1,352	2,787	195,340	5,607	729	125	16,288

(Table 9 continued on next page)

(Table 9 continued)

NORTHERN LOWER PENINSULA

County	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tamarack	Ash	Aspen	Balsam poplar	Basswood	Beech	White birch
Alcona	0	0	0	310	0	0	0	0	472	25,930	111	96	86	1,609
Alpena	0	220	0	585	14	4	16	0	700	9,184	44	67	100	1,056
Antrim	0	0	0	0	0	0	0	0	0	587	0	33	0	0
Arenac	0	0	0	0	0	0	0	0	10	416	0	10	0	60
Benzie	0	0	0	0	336	0	0	0	208	5,824	0	208	104	440
Charlevoix	0	0	0	0	671	0	0	0	0	0	0	0	0	0
Cheboygan	0	131	0	3,123	906	0	44	0	942	8,445	44	111	140	521
Clare	0	0	0	3,190	0	0	0	0	333	15,193	0	208	322	380
Crawford	0	0	0	3,613	98	51	0	0	107	1,184	0	52	104	78
Emmet	0	0	0	711	79	42	0	0	0	434	0	0	0	58
Gladwin	0	0	0	232	0	0	0	0	52	6,244	0	52	7	670
Grand Traverse	0	0	0	1,959	0	0	0	0	52	3,963	0	52	104	129
Iosco	0	0	0	11,408	761	21	0	0	52	802	0	52	0	19
Isabella	0	0	0	0	37	0	0	0	39	3,712	0	0	12	33
Kalkaska	0	12	5	3,494	1,607	47	0	0	104	9,494	0	135	208	215
Lake	0	0	0	5,127	0	0	0	0	429	18,423	0	416	417	131
Leelanau	0	0	0	0	0	0	0	0	208	832	0	208	104	58
Manistee	0	0	0	0	1,752	0	0	0	315	6,037	0	208	306	291
Mason	0	0	0	0	37	0	0	0	52	7,419	0	52	124	385
Mecosta	0	0	0	0	2,699	0	0	0	99	10,790	0	52	38	114
Midland	0	0	0	0	0	0	0	0	104	3,457	0	67	52	226
Missaukee	0	0	0	1,284	629	0	0	0	53	3,144	0	52	52	197
Montmorency	0	295	0	8,221	345	156	97	0	240	14,846	67	22	40	653
Newaygo	0	0	0	0	6,103	0	0	0	103	7,896	0	0	81	107
Oceana	0	0	0	0	3,222	0	0	0	480	5,123	0	208	448	72
Ogemaw	0	0	0	5,688	0	0	0	0	132	3,227	0	52	104	210
Osceola	0	0	0	0	2,205	0	0	0	45	14,183	0	48	55	291
Oscoda	0	97	0	8,727	241	120	32	0	206	9,354	22	48	46	608
Otsego	0	106	0	5,971	228	104	18	0	0	738	0	0	0	0
Presque Isle	0	706	58	3,859	152	80	133	0	220	11,400	67	22	20	1,933
Roscommon	0	0	0	9,226	0	0	0	0	1	8,075	0	0	0	151
Wexford	0	0	0	10,259	9,572	42	0	0	111	5,359	0	104	104	164
Total	0	1,567	63	86,987	31,694	667	340	0	5,869	221,715	355	2,635	3,178	10,859
SOUTHERN LOWER PENINSULA														
Allegan	0	0	0	1,154	1,154	0	0	0	6	427	0	0	0	12
Barry	0	0	0	0	240	0	0	0	0	48	0	0	0	0
Calhoun	0	0	0	0	101	0	0	0	0	0	0	0	0	0
Gratiot	0	0	0	0	0	0	0	0	140	584	0	0	50	0
Kent	0	0	0	0	363	0	0	0	706	928	0	0	315	1
Montcalm	0	0	0	0	1,241	0	0	0	483	3,605	0	0	180	15
Muskegon	0	0	0	0	3,797	0	0	0	8	3,124	0	0	0	16
Ottawa	0	0	0	0	3,855	0	0	0	0	13	0	0	0	0
Saginaw	0	0	0	0	52	0	0	0	1	187	0	0	0	2
Washtenaw	0	0	0	0	114	0	0	0	0	0	0	0	0	0
Total	0	0	0	1,154	10,922	0	0	0	1,344	8,916	0	0	545	46
State total	6,663	94,475	62,076	183,450	65,714	12,698	47,863	2,870	14,663	532,005	19,474	3,725	9,846	45,190

(Table 9 continued on next page)

(Table 9 continued)

EASTERN UPPER PENINSULA

County	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Walnut	Other hard-woods	All species
Alger	708	0	613	0	2,788	3,759	57	0	0	67	48,281
Chippewa	176	0	112	0	905	654	27	0	0	11	34,398
Delta	1,296	0	2,040	0	5,640	5,004	226	0	0	195	102,175
Luce	242	0	207	0	1,566	1,043	50	0	0	21	39,421
Mackinac	42	0	222	0	513	394	0	0	0	26	22,616
Menominee	1,240	0	5,715	0	4,909	3,580	100	0	0	495	93,531
Schoolcraft	377	0	511	0	1,837	910	121	0	0	54	49,142
Total	4,081	0	9,420	0	18,158	15,344	581	0	0	869	389,564

WESTERN UPPER PENINSULA

Baraga	2,004	0	1,968	0	6,812	3,546	100	0	0	356	63,202
Dickinson	718	0	1,490	0	3,710	1,966	111	0	0	193	73,018
Gogebic	1,597	0	1,618	0	3,277	1,229	4	0	0	321	40,349
Houghton	1,060	0	1,177	0	2,342	893	6	0	0	221	17,608
Iron	4,233	0	5,234	0	10,934	4,716	125	0	0	901	116,712
Keweenaw	14	0	93	0	343	82	0	0	0	8	1,062
Marquette	1,628	0	1,632	0	5,986	3,755	365	0	0	160	96,972
Ontonagon	1,655	0	1,653	0	3,709	3,222	0	0	0	334	49,323
Total	12,909	0	14,865	0	37,113	19,409	711	0	0	2,494	458,246

(Table 9 continued on next page)

(Table 9 continued)

County	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Walnut	Other hard-woods	All species
NORTHERN LOWER PENINSULA											
Alcona	0	0	0	0	110	2,555	9,997	1,150	0	16	42,442
Alpena	0	0	0	0	160	2,997	696	110	0	0	15,953
Antrim	0	0	0	0	0	104	0	0	0	0	724
Arenac	0	0	0	0	0	52	0	0	0	7	555
Benzie	0	0	0	0	104	2,600	728	104	0	40	10,696
Charlevoix	0	0	0	0	0	0	0	0	0	0	671
Cheboygan	0	0	0	0	243	3,858	213	26	0	0	18,747
Clare	0	0	0	0	354	3,485	8,097	507	0	161	32,230
Crawford	0	0	0	0	32	1,109	3,854	150	0	26	10,458
Emmet	0	0	0	0	0	89	0	0	0	0	1,413
Gladwin	0	0	0	0	0	742	1,040	104	0	0	9,143
Grand Traverse	0	0	0	0	104	759	111	53	0	52	7,338
Iosco	0	0	0	0	0	728	477	50	0	0	14,370
Isabella	0	0	0	0	70	245	1,342	258	0	4	5,752
Kalkaska	0	0	0	0	52	2,080	2,080	208	0	52	19,793
Lake	0	0	0	0	231	7,385	14,245	677	0	104	47,585
Leelanau	0	0	0	0	104	208	297	104	0	104	2,227
Manistee	0	0	0	0	347	4,337	2,970	430	0	129	17,122
Mason	0	0	0	0	104	3,208	4,314	114	0	93	15,902
Mecosta	0	0	0	0	121	318	2,350	152	0	10	16,743
Midland	0	0	0	0	0	1,144	416	0	0	0	5,466
Missaukee	0	0	0	0	3	1,055	1,666	155	0	52	8,342
Montmorency	0	0	0	0	60	1,214	4,658	410	0	0	31,324
Newaygo	0	0	0	0	155	667	4,629	966	0	13	20,720
Oceana	0	0	0	0	732	442	2,351	867	0	144	14,089
Ogemaw	0	0	0	0	20	727	3,050	630	0	47	13,887
Osceola	0	0	0	0	101	825	2,396	353	0	6	20,508
Oscoda	0	0	0	0	66	1,215	2,604	281	0	89	23,756
Otsego	0	0	0	0	0	0	110	0	0	0	7,275
Presque Isle	0	0	0	0	40	1,303	1,253	159	0	0	21,405
Roscommon	0	0	0	0	2	1,152	4,736	64	0	0	23,407
Wexford	0	0	0	0	118	4,747	5,151	309	0	135	36,175
Total	0	0	0	0	3,433	51,350	85,831	8,391	0	1,284	516,218
SOUTHERN LOWER PENINSULA											
Allegan	0	0	0	0	12	60	420	90	0	0	3,335
Barry	0	0	0	0	0	0	0	0	0	0	288
Calhoun	0	0	0	0	0	0	0	0	0	0	101
Gratiot	0	0	0	0	110	271	279	174	0	43	1,651
Kent	0	0	0	0	685	1,172	2,694	1,611	0	215	8,695
Montcalm	0	0	0	0	438	1,352	3,741	1,956	0	183	13,194
Muskegon	0	0	0	0	16	80	605	154	0	0	7,800
Ottawa	0	0	0	0	0	0	0	0	0	0	3,868
Saginaw	0	0	0	0	2	13	88	19	0	0	364
Washtenaw	0	0	0	0	0	0	0	0	0	0	114
Total	0	0	0	0	1,263	2,948	7,827	4,004	0	441	39,410
State total	16,990	0	24,285	0	59,967	89,051	94,950	12,395	0	5,088	1,403,438

Table 10.--Pulpwood receipts in Michigan by species group and area of origin, 1977

(In thousand standard cords, unpeeled)

Species group	Total	Area of origin		
		Michigan	Wisconsin	Other States
ROUNDWOOD:[1]				
Jack pine	135	125	10	0
Balsam fir	52	45	7	0
Red pine	61	57	4	0
Hemlock	62	52	10	0
Spruce	25	22	3	0
Other softwoods	21	17	4	0
Aspen	370	369	1	0
Oak	107	107	([2])	0
Soft maple	78	77	1	0
Birch	48	47	1	0
Hard maple	33	32	1	0
Other hardwoods	51	50	1	0
Total	1,043	1,000	43	0
RESIDUE:				
Softwood	17	16	1	0
Hardwood	173	143	21	9
All material	1,233	1,159	65	9

[1] Includes chips from roundwood.

[2] Less than 500 cords.

Table 11.--Saw log production in Michigan by species, 1972 and 1977

(In thousand board feet)[1]

Species	1972	1977	Change
SOFTWOODS:			
Cedar	8,514	4,228	-4,286
Balsam fir	1,194	3,439	2,245
Hemlock	19,014	8,724	-10,290
Jack pine	4,536	15,697	11,161
Red pine	7,975	21,973	13,998
White pine	17,164	30,841	13,677
Spruce	819	6,595	5,776
Tamarack	128	0	-128
Total	59,344	91,497	32,153
HARDWOODS:			
Ash	10,156	15,465	5,309
Aspen	63,694	98,361	34,667
Balsam poplar	([2])	244	([4])
Basswood	19,041	15,480	-3,561
Beech	22,399	19,035	-3,364
Paper birch	4,967	9,870	4,903
Yellow birch	17,072	4,018	-13,054
Cottonwood	8,055	3,139	-4,916
Elm	22,367	19,202	-3,165
Hickory	1,654	681	-973
Hard maple	110,365	90,352	-20,013
Soft maple	35,328	35,903	575
Red oak	62,074	82,766	20,692
White oak	14,014	22,590	8,576
Walnut	1,011([3])	271	-740
Other hardwoods	2,890	5,082	([4])
Total	395,087	422,459	27,372
All species	454,431	513,956	59,525

[1] International 1/4-inch rule.

[2] Included in other hardwoods.

[3] Includes balsam poplar.

[4] Not applicable.

Table 12.--Saw log production by unit, species, and state of destination, Michigan, 1977

(In thousand board feet)[1/]

ALL UNITS

Species	Michigan	Wisconsin	Indiana	Ohio	Total
SOFTWOODS:					
Cedar	4,226	2	0	0	4,228
Balsam fir	104	3,335	0	0	3,439
Hemlock	6,882	1,842	0	0	8,724
Jack pine	13,513	2,184	0	0	15,697
Red pine	12,593	9,380	0	0	21,973
White pine	19,994	10,847	0	0	30,841
Spruce	3,082	3,513	0	0	6,595
Tamarack	0	0	0	0	0
Total	60,394	31,103	0	0	91,497
HARDWOODS:					
Ash	15,293	11	161	0	15,465
Aspen	81,168	17,183	10	0	98,361
Balsam poplar	244	0	0	0	244
Basswood	14,660	699	121	0	15,480
Beech	18,825	0	210	0	19,035
Paper birch	8,305	1,565	0	0	9,870
Yellow birch	3,584	432	2	0	4,018
Cottonwood	3,041	0	98	0	3,139
Elm	17,892	1,296	14	0	19,202
Hickory	495	0	186	0	681
Hard maple	86,791	3,228	333	0	90,352
Soft maple	35,426	108	369	0	35,903
Red oak	80,859	22	1,885	0	82,766
White oak	22,128	0	462	0	22,590
Walnut	200	0	12	59	271
Other species	4,882	22	178	0	5,082
Total	393,793	24,566	4,041	59	422,459
All species	454,187	55,669	4,041	59	513,956

EASTERN UPPER PENINSULA

SOFTWOODS:					
Cedar	2,699	0	0	0	2,699
Balsam fir	17	0	0	0	17
Hemlock	2,090	0	0	0	2,090
Jack pine	5	780	0	0	785
Red pine	2,562	1,040	0	0	3,602
White pine	8,152	780	0	0	8,932
Spruce	1,270	0	0	0	1,270
Tamarack	0	0	0	0	0
Total	16,795	2,600	0	0	19,395
HARDWOODS:					
Ash	984	0	0	0	984
Aspen	7,261	0	0	0	7,261
Balsam poplar	244	0	0	0	244
Basswood	1,537	254	0	0	1,791
Beech	12,931	0	0	0	12,931
Paper birch	986	0	0	0	986
Yellow birch	1,537	0	0	0	1,537
Cottonwood	0	0	0	0	0
Elm	7,301	0	0	0	7,301
Hickory	0	0	0	0	0
Hard maple	27,581	0	0	0	27,581
Soft maple	5,191	0	0	0	5,191
Red oak	912	0	0	0	912
White oak	11	0	0	0	11
Walnut	0	0	0	0	0
Other species	108	0	0	0	108
Total	66,584	254	0	0	66,838
All species	83,379	2,854	0	0	86,233

(Table 12 continued on next page)

(Table 12 continued)

Species	Michigan	Wisconsin	Indiana	Ohio	Total
WESTERN UPPER PENINSULA					
SOFTWOODS:					
Cedar	1,041	2	0	0	1,043
Balsam fir	13	3,335	0	0	3,348
Hemlock	4,190	1,842	0	0	6,032
Jack pine	0	1,352	0	0	1,352
Red pine	1,684	8,340	0	0	10,024
White pine	6,092	10,067	0	0	16,159
Spruce	1,608	3,513	0	0	5,121
Tamarack	0	0	0	0	0
Total	14,628	28,451	0	0	43,079
HARDWOODS:					
Ash	1,340	11	0	0	1,351
Aspen	7,289	17,183	0	0	24,472
Balsam poplar	0	0	0	0	0
Basswood	2,729	445	0	0	3,174
Beech	1,051	0	0	0	1,051
Paper birch	5,032	1,565	0	0	6,597
Yellow birch	1,946	432	0	0	2,378
Cottonwood	0	0	0	0	0
Elm	7,293	1,296	0	0	8,589
Hickory	0	0	0	0	0
Hard maple	33,297	3,228	0	0	36,525
Soft maple	4,331	108	0	0	4,439
Red oak	3,250	22	0	0	3,272
White oak	0	0	0	0	0
Walnut	0	0	0	0	0
Other species	76	22	0	0	98
Total	67,634	24,312	0	0	91,946
All species	82,262	52,763	0	0	135,025
NORTHERN LOWER PENINSULA					
SOFTWOODS:					
Cedar	486	0	0	0	486
Balsam fir	74	0	0	0	74
Hemlock	602	0	0	0	602
Jack pine	13,508	52	0	0	13,560
Red pine	8,107	0	0	0	8,107
White pine	5,495	0	0	0	5,495
Spruce	204	0	0	0	204
Tamarack	0	0	0	0	0
Total	28,476	52	0	0	28,528
HARDWOODS:					
Ash	4,032	0	0	0	4,032
Aspen	64,122	0	0	0	64,122
Balsam poplar	0	0	0	0	0
Basswood	6,818	0	0	0	6,818
Beech	3,420	0	0	0	3,420
Paper birch	2,230	0	0	0	2,230
Yellow birch	41	0	0	0	41
Cottonwood	1,036	0	0	0	1,036
Elm	2,980	0	0	0	2,980
Hickory	69	0	0	0	69
Hard maple	15,716	0	0	0	15,716
Soft maple	11,059	0	0	0	11,059
Red oak	43,200	0	0	0	43,200
White oak	8,190	0	0	0	8,190
Walnut	60	0	0	0	60
Other species	985	0	0	0	985
Total	163,958	0	0	0	163,958
All species	192,434	52	0	0	192,486

(Table 12 continued on next page)

(Table 12 continued)

Species	SOUTHERN LOWER PENINSULA				
	Michigan	Wisconsin	Indiana	Ohio	Total
SOFTWOODS:					
Cedar	0	0	0	0	0
Balsam fir	0	0	0	0	0
Hemlock	0	0	0	0	0
Jack pine	0	0	0	0	0
Red pine	240	0	0	0	240
White pine	255	0	0	0	255
Spruce	0	0	0	0	0
Tamarack	0	0	0	0	0
Total	495	0	0	0	495
HARDWOODS:					
Ash	8,937	0	161	0	9,098
Aspen	2,496	0	10	0	2,506
Balsam poplar	0	0	0	0	0
Basswood	3,576	0	121	0	3,697
Beech	1,423	0	210	0	1,633
Paper birch	57	0	0	0	57
Yellow birch	60	0	2	0	62
Cottonwood	2,005	0	98	0	2,103
Elm	318	0	14	0	332
Hickory	426	0	186	0	612
Hard maple	10,197	0	333	0	10,530
Soft maple	14,845	0	369	0	15,214
Red oak	33,497	0	1,885	0	35,382
White oak	13,927	0	462	0	14,389
Walnut	140	0	12	59	211
Other species	3,713	0	178	0	3,891
Total	95,617	0	4,041	59	99,717
All species	96,112	0	4,041	59	100,212

1/International 1/4-inch rule.

Table 13.--Saw log production by unit, county, and species, Michigan, 1977

(In thousand board feet)

County	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tamarack	Ash	Aspen	Balsam poplar	Basswood	Beech	White birch
EASTERN UPPER PENINSULA														
Alger	41	0	1,594	0	121	2,198	121	0	190	57	0	174	4,972	0
Chippewa	325	5	45	0	463	695	312	0	294	1,495	97	406	446	251
Delta	397	0	30	0	0	1,537	39	0	19	312	0	282	32	46
Luce	71	5	43	520	1,342	1,720	102	0	157	1,684	0	76	3,887	121
Mackinac	192	5	87	5	298	340	627	0	162	1,023	147	243	588	137
Menominee	1,645	0	258	0	97	1,121	56	0	81	2,655	0	538	170	417
Schoolcraft	28	2	33	260	1,281	1,321	13	0	81	35	0	72	2,836	14
Total	2,699	17	2,090	785	3,602	8,932	1,270	0	984	7,261	244	1,791	12,931	986
WESTERN UPPER PENINSULA														
Baraga	39	0	640	0	16	367	69	0	25	397	0	163	0	1,449
Dickinson	556	0	119	520	535	1,025	85	0	75	1,826	0	659	42	92
Gogebic	0	1,334	1,392	0	2,793	2,995	1,334	0	361	7,425	0	460	0	1,135
Houghton	182	334	841	0	920	1,026	1,331	0	273	3,384	0	572	0	518
Iron	2	333	336	260	1,247	3,135	490	0	88	2,717	0	601	0	413
Keweenaw	45	0	347	0	1,036	932	139	0	5	19	0	14	0	421
Marquette	146	13	1,826	416	455	3,521	276	0	62	1,066	0	277	1,009	1,316
Ontonagon	73	1,334	531	156	3,022	3,158	1,397	0	462	7,638	0	428	0	1,253
Total	1,043	3,348	6,032	1,352	10,024	16,159	5,121	0	1,351	24,472	0	3,174	1,051	6,597
NORTHERN LOWER PENINSULA														
Alcona	0	20	0	348	257	150	20	0	14	2,982	0	27	13	40
Alpena	55	25	0	3,312	595	20	20	0	31	684	0	31	0	92
Antrim	0	2	54	250	414	26	2	0	427	1,354	0	1,424	367	56
Arenac	0	0	0	0	100	0	0	0	25	1,116	0	10	0	70
Bay	0	0	0	0	0	0	0	0	43	17	0	17	0	0
Benzie	0	0	0	0	82	43	0	0	211	244	0	207	239	0
Charlevoix	0	0	15	0	216	0	0	0	10	960	0	611	22	0
Cheboygan	0	2	0	0	35	375	2	0	110	4,743	0	475	287	83
Clare	0	0	0	104	182	109	0	0	212	4,265	0	162	10	31
Crawford	0	0	0	558	639	535	0	0	4	2,979	0	88	32	28
Emmet	0	0	15	0	162	0	0	0	422	3,081	0	791	326	156
Gladwin	0	0	0	0	5	0	0	0	50	2,688	0	50	0	225
Grand Traverse	0	0	40	0	372	372	0	0	280	88	0	91	16	0
Iosco	133	0	0	7	819	624	9	0	160	1,611	0	0	0	0
Isabella	0	0	0	0	0	69	0	0	171	151	0	107	116	62
Kalkaska	0	0	60	127	212	257	0	0	0	1,475	0	98	56	56
Lake	0	0	0	0	69	22	0	0	140	812	0	137	51	0
Leelanau	0	0	30	0	15	1	0	0	54	39	0	54	177	0
Manistee	0	0	0	0	159	58	0	0	167	847	0	98	215	0
Mason	0	0	0	0	51	22	0	0	111	520	0	102	108	0
Mecosta	0	0	0	0	0	41	0	0	371	1,201	0	159	92	10
Midland	0	0	0	0	108	0	0	0	208	3,420	0	248	0	201
Missaukee	1	1	3	5	5	240	0	0	2	1,838	0	5	142	140
Montmorency	55	5	0	4,486	1,246	352	0	0	88	4,702	0	315	140	201
Newaygo	0	0	0	0	0	35	0	0	213	780	0	107	25	0
Oceana	1	0	68	0	14	127	0	0	73	815	0	46	147	0
Ogemaw	0	0	0	111	270	587	0	0	54	6,571	0	50	50	274
Osceola	56	0	143	18	59	204	37	0	159	2,842	0	399	298	102
Oscoda	0	0	0	3,833	1,475	213	0	0	0	3,110	0	4	4	32
Otsego	0	2	0	179	118	107	2	0	75	2,199	0	163	35	125
Presque Isle	15	15	0	0	0	275	0	0	31	1,589	0	256	75	92
Roscommon	1	1	3	161	202	516	0	0	2	3,773	0	93	2	154
Wexford	169	1	171	61	226	115	112	0	114	626	0	393	375	0

(Table 13 continued)

SOUTHERN LOWER PENINSULA

County	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tama-rack	Ash	Aspen	Balsam poplar	Bass-wood	Beech	White birch
Allegan	0	0	0	0	0	67	0	0	508	20	0	31	0	0
Barry	0	0	0	0	0	0	0	0	597	47	0	325	97	0
Berrien	0	0	0	0	0	0	0	0	160	67	0	62	84	0
Branch	0	0	0	0	0	0	0	0	111	1	0	46	52	0
Calhoun	0	0	0	0	0	0	0	0	451	22	0	176	39	0
Cass	0	0	0	0	0	0	0	0	161	4	0	106	141	0
Clinton	0	0	0	0	0	0	0	0	318	0	0	107	194	0
Eaton	0	0	0	0	0	0	0	0	385	22	0	145	78	0
Genessee	0	0	0	0	0	0	0	0	60	1	0	61	0	0
Gratiot	0	0	0	0	0	0	0	0	60	12	0	102	4	0
Hillsdale	0	0	0	0	0	0	0	0	224	0	0	91	35	0
Huron	0	0	0	0	0	0	0	0	815	483	0	40	0	0
Ingham	0	0	0	0	0	0	0	0	201	3	0	218	3	0
Ionia	0	0	0	0	0	0	0	0	859	0	0	181	222	0
Jackson	0	0	0	0	0	0	0	0	428	22	0	340	39	0
Kalamazoo	0	0	0	0	0	0	0	0	0	0	0	10	0	0
Kent	0	0	0	0	26	24	0	0	713	93	0	287	120	0
Lapeer	0	0	0	0	0	0	0	0	42	15	0	54	0	0
Lenawee	0	0	0	0	0	0	0	0	234	0	0	90	25	0
Macomb	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monroe	0	0	0	0	0	0	0	0	111	0	0	66	18	0
Montcalm	0	0	0	0	207	0	0	0	391	447	0	445	203	57
Muskegon	0	0	0	0	0	138	0	0	1	0	0	14	1	0
Oakland	0	0	0	0	0	0	0	0	351	0	0	35	0	0
Ottawa	0	0	0	0	0	14	0	0	0	0	0	3	65	0
Saginaw	0	0	0	0	0	0	0	0	371	35	0	232	0	0
St.Clair	0	0	0	0	0	0	0	0	162	0	0	60	0	0
St.Joseph	0	0	0	0	0	0	0	0	113	13	0	80	99	0
Sanilac	0	0	0	0	0	0	0	0	504	271	0	0	0	0
Shiawassee	0	0	0	0	0	0	0	0	50	0	0	50	0	0
Tuscola	0	0	0	0	7	0	0	0	234	885	0	43	0	0
Van Buren	0	0	0	0	0	12	0	0	232	43	0	63	70	0
Washtenaw	0	0	0	0	0	0	0	0	244	0	0	134	44	0
Wayne	0	0	0	0	0	0	0	0	7	0	0	0	0	0
Total	0	0	0	0	240	255	0	0	9,098	2,506	0	3,697	1,633	57
State total	4,228	3,439	8,724	15,697	21,973	30,841	6,595	0	15,465	98,361	244	15,480	19,035	9,870

(Table 13 continued on next page)

(Table 13 continued)

County	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Walnut	Other hard-woods	All species
EASTERN UPPER PENINSULA											
Alger	556	0	1,261	0	9,183	1,654	130	0	0	89	22,341
Chippewa	1	0	375	0	2,319	479	104	11	0	0	8,123
Delta	94	0	1,927	0	1,958	84	14	0	0	19	6,690
Luce	118	0	436	0	5,923	1,443	150	0	0	0	17,798
Mackinac	29	0	782	0	2,097	217	52	0	0	0	7,031
Menominee	488	0	2,016	0	1,991	421	381	0	0	0	12,335
Schoolcraft	251	0	504	0	4,210	893	81	0	0	0	11,915
Total	1,537	0	7,301	0	27,581	5,191	912	11	0	108	86,233
WESTERN UPPER PENINSULA											
Baraga	329	0	1,174	0	5,746	442	82	0	0	0	10,938
Dickinson	292	0	1,852	0	1,348	442	368	0	0	50	9,886
Gogebic	36	0	845	0	3,575	397	38	0	0	13	24,133
Houghton	457	0	356	0	6,836	1,018	1,600	0	0	0	19,648
Iron	577	0	2,271	0	4,402	336	26	0	0	22	17,256
Keweenaw	53	0	0	0	967	452	776	0	0	0	5,206
Marquette	556	0	1,432	0	10,066	875	324	0	0	0	23,636
Ontonagon	78	0	659	0	3,585	477	58	0	0	13	24,322
Total	2,378	0	8,589	0	36,525	4,439	3,272	0	0	98	135,025
NORTHERN LOWER PENINSULA											
Alcona	0	0	0	0	180	53	1,395	451	60	0	6,010
Alpena	0	0	0	0	15	123	142	0	0	0	5,145
Antrim	0	0	693	0	1,146	339	211	70	0	0	6,835
Arenac	0	20	80	0	10	150	370	70	0	15	2,036
Bay	0	41	0	0	17	34	110	26	0	0	305
Benzie	0	0	8	0	443	237	491	0	0	101	2,306
Charlevoix	0	0	561	0	953	255	0	0	0	0	3,603
Cheboygan	0	0	213	0	867	457	11	0	0	0	7,660
Clare	0	140	0	19	553	753	3,270	390	0	0	10,200
Crawford	0	0	28	0	1,305	29	1,482	62	0	4	7,773
Emmet	0	0	570	0	1,375	498	54	27	0	0	7,477
Gladwin	0	15	2	0	372	491	870	10	0	0	4,778
Grand Trav	0	0	8	0	80	76	34	16	0	16	1,489
Iosco	0	0	0	0	116	80	847	195	0	0	4,601
Isabella	0	10	57	25	62	489	588	229	0	4	2,140
Kalkaska	0	0	56	0	389	47	1,385	528	0	0	4,746
Lake	0	0	10	3	450	916	6,458	531	0	48	9,647
Leelanau	0	0	0	0	173	28	0	0	0	0	571
Manistee	0	0	30	0	291	461	679	181	0	51	3,237
Mason	0	0	7	1	527	407	1,513	189	0	77	3,635
Mecosta	0	20	0	12	787	796	2,431	429	0	22	6,371
Midland	0	780	5	0	236	760	738	275	0	0	6,979
Missaukee	0	0	140	0	169	113	1,093	481	0	0	4,378
Montmorenc	23	0	150	0	432	283	651	258	0	75	13,462
Newaygo	0	0	0	8	385	981	5,076	1,452	0	41	9,103
Oceana	0	0	19	0	393	278	1,474	568	0	129	4,152
Ogemaw	0	0	30	0	367	295	2,115	434	0	24	11,232
Osceola	0	10	75	1	955	756	3,561	395	0	41	10,111
Oscoda	2	0	0	0	915	0	1,569	458	0	0	11,615
Otsego	15	0	75	0	465	0	606	131	0	75	4,372
Presque Isle	0	0	75	0	225	273	92	0	0	0	3,013
Roscommon	1	0	0	0	350	461	3,803	302	0	254	10,079
Wexford	0	0	88	0	713	140	81	32	0	8	3,425
Total	41	1,036	2,980	69	15,716	11,059	43,209	6,180	60	1,021	211,000

(Table 13 continued)

SOUTHERN LOWER PENINSULA

County	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Walnut	Other hard-woods	All species
Allegan	0	0	0	0	492	481	2,043	792	1	376	4,811
Barry	0	22	22	22	1,017	879	3,089	1,123	5	624	7,869
Berrien	13	55	1	27	237	213	626	254	0	90	1,889
Branch	0	55	0	14	173	166	354	207	12	7	1,198
Calhoun	0	29	22	25	525	949	1,949	1,027	1	461	5,676
Cass	14	28	6	83	268	307	1,630	839	16	110	3,713
Clinton	0	18	46	0	167	609	1,059	118	3	246	2,885
Eaton	0	23	68	22	485	1,077	1,431	442	16	514	4,708
Genessee	0	63	0	0	120	200	250	100	0	0	855
Gratiot	0	70	0	0	287	554	331	313	0	0	1,733
Hillsdale	0	70	0	29	215	388	681	326	45	27	2,131
Huron	0	342	0	0	452	502	630	325	0	0	3,589
Ingham	0	0	0	0	385	751	1,027	686	11	9	3,294
Ionia	0	33	46	0	1,142	1,668	3,259	835	1	599	8,845
Jackson	0	63	22	57	674	1,207	2,146	1,264	49	128	6,439
Kalamazoo	0	0	0	1	10	18	20	7	4	8	78
Kent	0	0	0	8	1,043	866	4,699	973	1	422	9,275
Lapeer	0	63	0	0	50	141	122	162	0	8	657
Lenawee	21	39	0	39	37	269	540	284	12	12	1,602
Macomb	0	0	0	0	0	0	55	83	0	0	138
Monroe	0	250	14	43	47	221	559	378	10	10	1,727
Montcalm	0	0	57	1	789	694	1,646	225	1	112	5,275
Muskegon	0	0	0	0	17	105	1,335	439	3	14	2,067
Oakland	0	100	0	0	100	405	799	446	0	0	2,236
Ottawa	0	0	0	0	0	0	54	15	0	0	151
Saginaw	0	190	0	0	246	659	645	247	0	0	2,625
St. Clair	0	21	0	0	150	293	545	660	0	0	1,891
St. Joseph	0	28	4	55	369	346	992	302	0	31	2,432
Sanilac	0	181	0	0	200	302	392	229	0	0	2,079
Shiawassee	0	50	0	0	100	100	100	100	0	0	550
Tuscola	0	190	0	0	126	166	190	163	0	22	2,026
Van Buren	14	48	3	7	563	291	1,233	517	1	42	3,139
Washtenaw	0	65	14	172	44	387	948	505	19	19	2,595
Wayne	0	7	7	7	0	0	3	3	0	0	34
Total	62	2,103	332	612	10,530	15,214	35,382	14,389	211	3,891	100,212
State total	4,018	3,139	19,202	681	90,352	35,903	82,766	22,590	271	5,082	513,956

1/ International 1/4-inch rule.

Table 14.--Saw log receipts by species, unit, and state of origin, Michigan, 1977

(In thousand board feet)[1/]

ALL UNITS

Species	All states	Michigan	Wisconsin	Ohio
SOFTWOODS:				
Cedar	4,314	4,226	88	0
Balsam fir	104	104	0	0
Hemlock	6,882	6,882	0	0
Jack pine	13,513	13,513	0	0
Red pine	12,593	12,593	0	0
White pine	20,058	19,994	64	0
Spruce	3,088	3,082	6	0
Total	60,552	60,394	158	0
HARDWOODS:				
Ash	15,504	15,293	81	130
Aspen	81,677	81,168	509	0
Balsam poplar	244	244	0	0
Basswood	14,766	14,660	16	90
Beech	18,850	18,825	0	25
Paper birch	8,391	8,305	86	0
Yellow birch	3,619	3,584	35	0
Cottonwood	3,080	3,041	0	39
Elm	18,105	17,892	213	0
Hickory	534	495	0	39
Hard maple	87,099	86,791	283	25
Soft maple	35,856	35,426	173	257
Red oak	81,345	80,859	39	447
White oak	22,320	22,128	0	192
Walnut	212	200	0	12
Other species	4,894	4,882	0	12
Total	396,496	393,793	1,435	1,268
All species	457,048	454,187	1,593	1,268

EASTERN UPPER PENINSULA

Species	All states	Michigan	Wisconsin
SOFTWOODS:			
Cedar	3,317	3,229	88
Balsam fir	3	3	0
Hemlock	3,736	3,736	0
Jack pine	5	5	0
Red pine	2,549	2,549	0
White pine	11,332	11,268	64
Spruce	1,438	1,438	0
Total	22,380	22,228	152
HARDWOODS:			
Ash	962	881	81
Aspen	8,103	7,788	315
Balsam poplar	244	244	0
Basswood	1,855	1,850	5
Beech	13,982	13,982	0
Paper birch	1,311	1,225	86
Yellow birch	2,051	2,039	12
Cottonwood	0	0	0
Elm	8,543	8,406	137
Hickory	0	0	0
Hard maple	32,236	32,074	162
Soft maple	5,612	5,450	162
Red oak	1,408	1,408	0
White oak	0	0	0
Walnut	0	0	0
Other species	108	108	0
Total	76,415	75,455	960
All species	98,795	97,683	1,112

(Table 14 continued on next page)

(Table 14 continued)

WESTERN UPPER PENINSULA

Species	All states	Michigan	Wisconsin
SOFTWOODS:			
Cedar	511	511	0
Balsam fir	10	10	0
Hemlock	2,544	2,544	0
Jack pine	0	0	0
Red pine	1,680	1,680	0
White pine	2,976	2,976	0
Spruce	1,429	1,423	6
Total	9,150	9,144	6
HARDWOODS:			
Ash	1,308	1,308	0
Aspen	6,687	6,493	194
Balsam poplar	0	0	0
Basswood	2,292	2,281	11
Beech	0	0	0
Paper birch	4,712	4,712	0
Yellow birch	1,467	1,444	23
Cottonwood	0	0	0
Elm	6,102	6,026	76
Hickory	0	0	0
Hard maple	28,115	27,994	121
Soft maple	3,813	3,802	11
Red oak	2,777	2,738	39
White oak	0	0	0
Walnut	0	0	0
Other species	76	76	0
Total	57,349	56,874	475
All species	66,499	66,018	481

NORTHERN LOWER PENINSULA

Species	All states	Michigan
SOFTWOODS:		
Cedar	486	486
Balsam fir	91	91
Hemlock	602	602
Jack pine	13,508	13,508
Red pine	8,331	8,331
White pine	5,440	5,440
Spruce	221	221
Total	28,679	28,679
HARDWOODS:		
Ash	3,612	3,612
Aspen	62,390	62,390
Balsam poplar	0	0
Basswood	6,894	6,894
Beech	3,433	3,433
Paper birch	2,368	2,368
Yellow birch	41	41
Cottonwood	914	914
Elm	3,199	3,199
Hickory	48	48
Hard maple	16,859	16,859
Soft maple	11,421	11,421
Red oak	41,602	41,602
White oak	7,947	7,947
Walnut	60	60
Other species	1,000	1,000
Total	161,788	161,788
All species	190,467	190,467

(Table 14 continued on next page)

(Table 14 continued)

Species	SOUTHERN LOWER PENINSULA All states	Michigan	Ohio
SOFTWOODS:			
Cedar	0	0	0
Balsam fir	0	0	0
Hemlock	0	0	0
Jack pine	0	0	0
Red pine	33	33	0
White pine	310	310	0
Spruce	0	0	0
Total	343	343	0
HARDWOODS:			
Ash	9,622	9,492	130
Aspen	4,497	4,497	0
Balsam poplar	0	0	0
Basswood	3,725	3,635	90
Beech	1,435	1,410	25
Paper birch	0	0	0
Yellow birch	60	60	0
Cottonwood	2,166	2,127	39
Elm	261	261	0
Hickory	486	447	39
Hard maple	9,889	9,864	25
Soft maple	15,010	14,753	257
Red oak	35,558	35,111	447
White oak	14,373	14,181	192
Walnut	152	140	12
Other species	3,710	3,698	12
Total	100,944	99,676	1,268
All species	101,287	100,019	1,268

1/International 1/4-inch rule.

Table 15.--Veneer log and bolt production by species and state or country of destination, Michigan, 1977

(In thousand board feet)1/

Species	Michigan	Wisconsin	Indiana	Ohio	Kentucky	Canada	Total
Ash	11	142	4	0	0	0	157
Aspen	22,186	0	0	0	0	32	22,218
Basswood	738	199	26	0	0	15	978
Beech	11	89	0	0	0	15	115
Paper birch	988	401	0	0	0	0	1,389
Yellow birch	2,600	3,054	0	0	0	0	5,654
Cottonwood	165	0	0	0	0	0	165
Elm	11	457	47	0	0	0	515
Hickory	0	0	43	0	0	0	43
Hard maple	3,078	3,343	501	137	0	489	7,548
Soft maple	172	134	0	0	0	0	306
Red oak	388	658	808	0	286	252	2,392
White oak	0	0	478	68	113	0	659
Walnut	0	0	338	41	114	0	493
Other species	30	33	43	0	0	0	106
All species	30,378	8,510	2,288	246	513	803	42,738

1/International 1/4-inch rule.

Table 16.--Veneer log production by unit, county, and species group, Michigan, 1977

(In thousand board feet)[1/]

County	Ash	Aspen	Bass-wood	Beech	White birch	Yellow birch	Cotton-wood	Elm
EASTERN UPPER PENINSULA								
Alger	0	0	0	37	183	1,212	0	23
Chippewa	0	0	0	3	39	151	0	22
Delta	0	0	0	0	274	112	0	16
Luce	0	0	0	19	126	779	0	14
Mackinac	0	17	0	3	39	116	0	16
Menominee	0	0	0	0	182	110	0	16
Schoolcraft	0	0	0	23	129	789	0	22
Total	0	17	0	85	972	3,269	0	129
WESTERN UPPER PENINSULA								
Baraga	0	0	0	0	21	286	0	32
Dickinson	0	0	0	0	231	108	0	10
Gogebic	142	9,900	48	0	13	296	0	29
Houghton	0	0	69	0	16	292	0	18
Iron	0	2,200	0	0	27	312	0	189
Keweenaw	0	0	0	0	8	123	0	8
Marquette	0	0	0	19	78	668	0	35
Ontonagon	0	9,900	72	0	23	300	0	54
Total	142	22,000	189	19	417	2,385	0	375
NORTHERN LOWER PENINSULA								
Antrim	0	0	78	0	0	0	0	0
Benzie	0	0	0	0	0	0	0	0
Charlevoix	0	0	98	0	0	0	0	0
Cheboygan	0	0	92	0	0	0	0	0
Crawford	0	0	0	0	0	0	60	0
Emmet	0	15	119	0	0	0	0	0
Manistee	0	0	0	0	0	0	0	0
Montmorency	0	0	98	0	0	0	0	0
Oceana	11	171	86	11	0	0	0	11
Otsego	0	0	98	0	0	0	0	0
Presque Isle	0	0	84	0	0	0	0	0
Total	11	186	753	11	0	0	60	11
SOUTHERN LOWER PENINSULA								
Allegan	1	0	0	0	0	0	0	0
Barry	0	0	0	0	0	0	0	0
Berrien	0	10	5	0	0	0	78	0
Branch	0	0	0	0	0	0	0	0
Calhoun	0	0	16	0	0	0	0	0
Cass	0	0	5	0	0	0	0	0
Clinton	0	0	0	0	0	0	0	0
Eaton	0	0	0	0	0	0	0	0
Hillsdale	0	0	5	0	0	0	0	0
Ionia	0	0	0	0	0	0	0	0
Jackson	0	0	5	0	0	0	0	0
Kalamazoo	0	0	0	0	0	0	0	0
Kent	1	0	0	0	0	0	0	0
Montcalm	1	0	0	0	0	0	0	0
Muskegon	1	0	0	0	0	0	0	0
Ottawa	0	0	0	0	0	0	0	0
Saginaw	0	0	0	0	0	0	0	0
St. Joseph	0	0	0	0	0	0	0	0
Van Buren	0	5	0	0	0	0	27	0
Total	4	15	36	0	0	0	105	0
State total	157	22,218	978	115	1,389	5,654	165	515

(Table 16 continued on next page)

(Table 16 continued)

County	Hickory	Hard maple	Soft maple	Red oak	White oak	Walnut	Other hard-woods	All species
EASTERN UPPER PENINSULA								
Alger	0	1,774	2	156	0	0	3	3,390
Chippewa	0	13	0	50	0	0	2	280
Delta	0	9	0	0	0	0	2	413
Luce	0	724	0	249	0	0	2	1,913
Mackinac	0	54	0	50	0	0	2	297
Menominee	0	9	0	0	0	0	2	319
Schoolcraft	0	850	1	97	0	0	2	1,913
Total	0	3,433	3	602	0	0	15	8,525
WESTERN UPPER PENINSULA								
Baraga	0	400	0	0	0	0	2	741
Dickinson	0	24	0	0	0	0	1	374
Gogebic	0	404	0	0	0	0	3	10,835
Houghton	0	163	0	0	0	0	2	560
Iron	0	69	101	21	0	0	3	2,922
Keweenaw	0	10	0	98	0	0	1	248
Marquette	0	570	4	494	0	0	3	1,871
Ontonagon	0	577	26	0	0	0	3	10,955
Total	0	2,217	131	613	0	0	18	28,506
NORTHERN LOWER PENINSULA								
Antrim	0	158	0	0	0	0	0	236
Benzie	0	3	0	0	0	0	0	3
Charlevoix	0	194	0	0	0	0	0	292
Cheboygan	0	158	0	0	0	0	0	250
Crawford	0	0	0	0	0	0	0	60
Emmet	0	206	0	0	0	0	0	340
Manistee	0	25	0	0	0	0	0	25
Montmorency	0	182	0	0	0	0	0	280
Oceana	0	0	51	0	0	0	0	341
Otsego	0	170	0	0	0	0	0	268
Presque Isle	0	146	0	0	0	0	0	230
Total	0	1,242	51	0	0	0	0	2,325
SOUTHERN LOWER PENINSULA								
Allegan	3	42	0	40	23	169	6	284
Barry	2	74	0	43	21	201	5	346
Berrien	3	59	51	17	0	0	30	253
Branch	0	14	0	88	51	7	0	160
Calhoun	5	25	0	23	114	35	0	218
Cass	5	55	0	216	73	12	3	369
Clinton	0	6	0	0	0	2	0	8
Eaton	0	59	0	0	0	10	0	69
Hillsdale	3	23	0	222	48	9	0	310
Ionia	1	56	0	16	11	1	2	87
Jackson	5	24	0	28	38	2	0	102
Kalamazoo	1	26	0	30	14	3	2	76
Kent	3	46	0	44	22	2	6	124
Montcalm	3	41	0	55	26	2	6	134
Muskegon	6	48	0	91	42	36	6	230
Ottawa	1	19	0	31	14	1	2	68
Saginaw	0	13	0	26	125	0	0	164
St. Joseph	0	0	70	91	0	0	0	161
Van Buren	2	26	0	116	37	1	5	219
Total	43	656	121	1,177	659	493	73	3,382
State total	43	7,548	306	2,392	659	493	106	42,738

Table 17.--Veneer log and bolt receipts by species and state of origin, Michigan, 1977

(In thousand board feet)[1/]

Species	All states	Michigan	Indiana	Kentucky
HARDWOODS:				
Ash	27	11	8	8
Aspen	22,186	22,186	0	0
Basswood	738	738	0	0
Beech	123	11	56	56
Paper birch	988	988	0	0
Yellow birch	2,600	2,600	0	0
Cottonwood	325	165	80	80
Elm	11	11	0	0
Hard maple	3,078	3,078	0	0
Soft maple	172	172	0	0
Red oak	476	388	44	44
Other species	114	30	42	42
Total	30,838	30,378	230	230
All species	30,838	30,378	230	230

[1/]International 1/4-inch rule.

Table 18.--Commercial post production by unit, county, and species, Michigan, 1977

(In thousand pieces)

County	Cedar	Balsam fir	Red pine	White pine	Spruce
EASTERN UPPER PENINSULA					
Chippewa	36	0	0	0	0
Delta	351	227	0	0	5
Menominee	741	413	0	0	0
Schoolcraft	5	1	0	0	0
Total	1,133	641	0	0	5
WESTERN UPPER PENINSULA					
Baraga	3	0	0	18	0
Dickinson	83	0	0	0	0
Iron	0	0	9	0	0
Marquette	21	6	0	0	1
Total	107	6	9	18	1
NORTHERN LOWER PENINSULA					
Alcona	5	0	0	0	0
Alpena	326	241	0	0	0
Clare	1	0	0	0	0
Isabella	11	0	0	0	0
Mecosta	2	0	0	0	0
Montmorency	115	35	0	0	0
Presque Isle	195	105	0	0	0
Total	655	381	0	0	0
SOUTHERN LOWER PENINSULA					
Allegan	0	0	5	0	0
Ottawa	0	0	5	0	0
Total	0	0	10	0	0
All units	1,895	1,028	19	18	6

Table 19.--Pole production by unit, county, and species, Michigan, 1977

(In number of pieces)

County	Cedar	Balsam fir	Jack pine	Red pine	Spruce	Aspen
EASTERN UPPER PENINSULA						
Alger	0	0	16	1,633	0	0
Delta	3,733	360	11	2,289	360	0
Luce	0	0	6	545	0	0
Menominee	3,733	360	0	1,200	360	0
Schoolcraft	3,733	480	11	2,689	480	0
Total	11,199	1,200	44	8,356	1,200	0
WESTERN UPPER PENINSULA						
Houghton	500	0	0	0	0	0
Keweenaw	4,500	0	0	0	0	0
Marquette	0	0	17	1,634	0	0
Total	5,000	0	17	1,634	0	0
NORTHERN LOWER PENINSULA						
Ogemaw	0	0	5	544	0	0
Osceola	0	0	11	1,089	0	0
Presque Isle	0	0	0	0	0	3,000
Roscommon	0	0	11	1,089	0	0
Total	0	0	27	2,722	0	3,000
SOUTHERN LOWER PENINSULA						
Allegan	0	0	0	125	0	0
Ottawa	0	0	0	125	0	0
Total	0	0	0	250	0	0
All units	16,199	1,200	88	12,962	1,200	3,000

Table 20.--Residue produced at primary wood-using mills by type of material and use, unit, and county, Michigan, 1977

(In thousand tons green weight)

EASTERN UPPER PENINSULA

County and type of use	Wood residue							
	Total		Coarse 1/		Fine 2/		Bark 3/	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Alger								
Fiber products	2.41	43.44	2.41	43.44	0	0	0	0
Industrial fuel	1.10	22.16	.01	1.94	1.09	20.22	.77	12.63
Domestic fuel	0	4.78	0	4.78	0	0	.33	.03
Miscellaneous 4/	.10	9.92	0	0	.10	9.92	.15	5.44
Not used	.50	3.19	.17	0	.33	3.19	.16	1.93
Total	4.11	83.49	2.59	50.16	1.52	33.33	1.41	20.03
Chippewa								
Fiber products	0	1.39	0	1.39	0	0	0	0
Domestic fuel	1.49	1.88	1.49	1.88	0	0	.58	1.00
Miscellaneous 4/	.37	1.61	0	0	.37	1.61	.01	.35
Not used	.50	.30	0	0	.50	.30	.02	0
Total	2.36	5.18	1.49	3.27	.87	1.91	.61	1.35
Delta								
Fiber products	2.89	.72	2.89	.72	0	0	0	0
Industrial fuel	1.10	5.41	.71	5.41	.39	0	.27	2.42
Domestic fuel	.28	.65	.28	.65	0	0	.01	.13
Miscellaneous 4/	.12	3.87	0	0	.12	3.87	1.74	.30
Not used	1.78	.57	.01	.01	1.77	.56	.51	.19
Total	6.17	11.22	3.89	6.79	2.28	4.43	2.53	3.04
Luce								
Fiber products	2.22	10.09	2.22	10.09	0	0	0	0
Industrial fuel	1.17	4.68	0	0	1.17	4.68	0	0
Domestic fuel	.96	3.43	.96	3.43	0	0	.17	.57
Miscellaneous 4/	.51	2.60	0	0	.51	2.60	1.16	4.70
Not used	.90	2.83	.46	1.42	.44	1.41	.17	.57
Total	5.76	23.63	3.64	14.94	2.12	8.69	1.50	5.84
Mackinac								
Fiber products	0	1.18	0	1.18	0	0	0	0
Industrial fuel	0	.96	0	.96	0	0	.01	.39
Domestic fuel	1.60	3.83	1.60	3.83	0	0	.48	1.76
Miscellaneous 4/	.57	2.32	0	0	.57	2.32	0	.30
Not used	.75	1.27	.25	.08	.50	1.19	.08	.04
Total	2.92	9.56	1.85	6.05	1.07	3.51	.57	2.49
Menominee								
Fiber products	9.74	14.66	9.74	14.66	0	0	0	0
Industrial fuel	5.97	15.35	.45	8.03	5.52	7.32	4.09	6.49
Domestic fuel	2.68	.30	2.68	.30	0	0	.61	.12
Miscellaneous 4/	2.34	4.39	0	0	2.34	4.39	1.26	1.98
Not used	1.96	2.56	1.47	.56	.49	2.00	1.61	1.35
Total	22.69	37.26	14.34	23.55	8.35	13.71	7.57	9.94
Schoolcraft								
Fiber products	2.06	2.05	2.06	2.05	0	0	0	0
Not used	1.37	1.37	.11	.11	1.26	1.26	.92	.80
Total	3.43	3.42	2.17	2.16	1.26	1.26	.92	.80
All counties								
Fiber products	19.32	73.53	19.32	73.53	0	0	0	0
Industrial fuel	9.34	48.56	1.17	16.34	8.17	32.22	5.14	21.93
Domestic fuel	7.01	14.87	7.01	14.87	0	0	2.18	3.61
Miscellaneous 4/	4.01	24.71	0	0	4.01	24.71	4.32	13.07
Not used	7.76	12.09	2.47	2.18	5.29	9.91	3.47	4.88
Total	47.44	173.76	29.97	106.92	17.47	66.84	15.11	43.49

(Table 20 continued on next page)

(Table 20 continued)

WESTERN UPPER PENINSULA

County and type of use	Wood residue							
	Total		Coarse 1/		Fine 2/		Bark 3/	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwoo
Baraga								
Fiber products	1.35	11.45	1.35	11.45	0	0	0	
Industrial fuel	0	.35	0	.09	0	.26	0	.(
Domestic fuel	0	.35	0	.35	0	0	0	
Miscellaneous 4/	.03	3.03	0	0	.03	3.03	0	
Not used	.75	3.63	0	0	.75	3.63	.60	5.(
Total	2.13	18.81	1.35	11.89	.78	6.92	.60	5.(
Dickinson								
Fiber products	0	5.33	0	5.33	0	0	0	
Industrial fuel	0	3.65	0	.35	0	3.30	0	2.4
Domestic fuel	.03	.05	.03	.05	0	0	0	.(
Miscellaneous 4/	0	.02	0	0	0	.02	0	
Not used	.12	.04	.06	.02	.06	.02	.03	.(
Total	.15	9.09	.09	5.75	.06	3.34	.03	2.4
Gogebic								
Fiber products	.72	13.02	.72	13.02	0	0	0	
Industrial fuel	2.70	12.42	1.44	4.93	1.26	7.49	.88	5.1
Miscellaneous 4/	0	16.82	0	15.44	0	1.38	0	.6
Not used	0	28.08	0	0	0	28.08	.03	13.6
Total	3.42	70.34	2.16	33.39	1.26	36.95	.91	19.4
Houghton								
Fiber products	.51	13.21	.51	13.21	0	0	0	
Domestic fuel	1.17	4.86	1.17	4.86	0	0	.43	.9
Miscellaneous 4/	.65	2.66	0	0	.65	2.66	.08	.5
Not used	.68	8.31	.23	.28	.45	8.03	.17	6.3
Total	3.01	29.04	1.91	18.35	1.10	10.69	.68	7.8
Iron								
Fiber products	.36	2.60	.36	2.60	0	0	0	
Domestic fuel			.04	1.40	.02	1.70	.01	1.8
Total	.63	8.73	.40	5.52	.23	3.21	.14	2.3
Keweenaw								
Industrial fuel	7.43	7.44	4.70	4.70	2.73	2.74	1.87	2.0
Miscellaneous 4/	0	0	0	0	0	0	.08	(
Total	7.43	7.44	4.70	4.70	2.73	2.74	1.95	2.0
Marquette								
Fiber products	.87	8.40	.87	8.40	0	0	0	(
Industrial fuel	.29	5.79	.29	5.79	0	0	0	(
Domestic fuel	.15	.22	.15	.22	0	0	.06	.0
Miscellaneous 4/	.51	7.58	0	0	.51	7.58	.25	3.0
Not used	.58	.80	.20	0	.38	.80	.27	2.9
Total	2.40	22.79	1.51	14.41	.89	8.38	.58	6.1
Ontonagon								
Domestic fuel	.15	0	.15	0	0	0	.06	(
Miscellaneous 4/	.09	0	0	0	.09	0	0	(
Total	.24	0	.15	0	.09	0	.06	(
All counties								
Fiber products	3.81	54.01	3.81	54.01	0	0	0	(
Industrial fuel	10.42	29.65	6.43	15.86	3.99	13.79	2.75	9.62
Domestic fuel	1.50	7.00	1.50	7.00	0	0	.55	1.07
Miscellaneous 4/	1.49	31.62	0	15.44	1.49	16.18	.54	4.7(
Not used	2.19	43.96	.53	1.70	1.66	42.26	1.11	29.85
Total	19.41	166.24	12.27	94.01	7.14	72.23	4.95	45.24

(Table 20 continued on next pag

ble 20 continued)

NORTHERN LOWER PENINSULA

nty and e of use	Wood residue							
	Total		Coarse 1/		Fine 2/		Bark 3/	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
ona								
iber products	.67	4.68	.67	4.68	0	0	0	0
omestic fuel	1.88	2.37	1.88	2.37	0	0	0	0
iscellaneous 4/	1.29	2.54	0	0	1.29	2.54	.22	1.03
ot used	.19	3.43	0	1.17	.19	2.26	.82	2.48
Total	4.03	13.02	2.55	8.22	1.48	4.80	1.04	3.51
ena								
omestic fuel	.03	1.85	.03	1.85	0	0	0	.75
iscellaneous 4/	.05	.29	0	0	.05	.29	.51	0
ot used	.19	2.40	.14	1.02	.05	1.38	.24	.46
Total	.27	4.54	.17	2.87	.10	1.67	.75	1.21
rim								
iber products	.02	.69	.02	.69	0	0	0	0
ndustrial fuel	.69	.67	.69	.67	0	0	0	0
omestic fuel	.13	3.88	.13	3.88	0	0	0	.18
iscellaneous 4/	.49	2.51	0	0	.49	2.51	.44	.47
ot used	.04	.55	.03	.01	.01	.54	.04	1.51
Total	1.37	8.30	.87	5.25	.50	3.05	.48	2.16
nac								
iber products	0	.57	0	.57	0	0	0	0
ndustrial fuel	0	.54	0	.54	0	0	0	.23
omestic fuel	.07	.99	.07	.99	0	0	0	.28
iscellaneous 4/	.25	4.92	.20	3.81	.05	1.11	.12	1.99
ot used	.11	2.33	0	0	.11	2.33	0	.02
Total	.43	9.35	.27	5.91	.16	3.44	.12	2.52
ndustrial fuel	0	.20	0	.20	0	0	0	0
omestic fuel	0	.24	0	.24	0	0	0	0
iscellaneous 4/	0	0	0	0	0	0	0	.02
ot used	0	.26	0	0	0	.26	0	.17
Total	0	.70	0	.44	0	.26	0	.19
zie								
ndustrial fuel	0	.03	0	.02	0	.01	0	0
omestic fuel	.01	.33	.01	.33	0	0	0	0
iscellaneous 4/	.01	.22	0	0	.01	.22	0	0
ot used	0	.04	0	.04	0	0	.01	.16
Total	.02	.62	.01	.39	.01	.23	.01	.16
rlevoix								
iber products	.92	7.29	.92	7.29	0	0	0	.01
ndustrial fuel	.10	.92	0	.72	.10	.20	.07	.14
omestic fuel	0	1.46	0	1.46	0	0	0	.11
iscellaneous 4/	.43	5.24	0	0	.43	5.24	1.41	3.43
ot used	.01	.07	0	0	.01	.07	.03	.29
Total	1.46	14.98	.92	9.47	.54	5.51	1.51	3.98
boygan								
iber products	1.11	15.24	1.11	15.24	0	0	0	0
ndustrial fuel	0	.43	0	.17	0	.26	0	.07
omestic fuel	0	.27	0	.27	0	0	0	.26
iscellaneous 4/	.64	4.46	0	0	.64	4.46	.47	6.23
ot used	0	4.91	0	.32	0	4.59	0	.23
Total	1.75	25.31	1.11	16.00	.64	9.31	.47	6.79
re								
iber products	.06	8.66	.06	8.66	0	0	.03	1.28
omestic fuel	.01	.77	.01	.77	0	0	.01	.80
iscellaneous 4/	.05	5.06	0	0	.05	5.06	0	.90
ot used	0	.43	0	0	0	.43	0	1.03
Total	.12	14.92	.07	9.43	.05	5.49	.04	4.01

(Table 20 continued on next page)

(Table 20 continued)

NORTHERN LOWER PENINSULA

County and type of use	Wood residue							
	Total		Coarse 1/		Fine 2/		Bark 3/	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardw
Crawford								
Fiber products	4.18	16.85	4.18	16.85	0	0	0	
Industrial fuel	.01	0	.01	0	0	0	0	
Domestic fuel	.02	.01	.02	.01	0	0	0	
Miscellaneous 4/	.02	.10	0	0	.02	.10	1.79	7
Not used	3.30	10.73	.55	.64	2.75	10.09	.23	
Total	7.53	27.69	4.76	17.50	2.77	10.19	2.02	7
Emmet								
Fiber products	.02	2.03	.02	2.03	0	0	0	
Industrial fuel	0	8.58	0	6.18	0	2.40	0	1
Domestic fuel	0	.51	0	.51	0	0	0	
Miscellaneous 4/	.01	1.53	0	0	.01	1.53	0	
Not used	0	2.63	0	0	0	2.63	0	1.
Total	.03	15.28	.02	8.72	.01	6.56	0	4.
Gladwin								
Fiber products	0	1.84	0	1.84	0	0	0	
Industrial fuel	0	.02	0	.02	0	0	0	
Domestic fuel	0	.48	0	.48	0	0	0	
Miscellaneous 4/	0	1.10	0	0	0	1.10	0	
Not used	0	.27	0	0	0	.27	0	
Total	0	3.71	0	2.34	0	1.37	0	1.
Iosco								
Fiber products	.09	.01	.09	.01	0	0	0	
Industrial fuel	.01	.21	0	.21	.01	0	0	
Domestic fuel	.01	1.07	.01	1.07	0	0	0	
Miscellaneous 4/	.05	.75	0	0	.05	.75	.03	
Not used	0	0	0	0	0	0	0	
Total	.16	2.04	.10	1.29	.06	.75	.03	
Isabella								
Fiber products	0	.27	0	.27	0	0	0	
Domestic fuel	.65	13.01	.65	13.01	0	0	0	
Miscellaneous 4/	.22	7.69	0	0	.22	7.69	.16	4.
Not used	.16	.04	0	0	.16	.04	.14	
Total	1.03	21.01	.65	13.28	.38	7.73	.30	5.
Kalkaska								
Fiber products	.02	7.30	.02	7.30	0	0	0	
Industrial fuel	0	.38	0	.38	0	0	0	
Domestic fuel	.56	.17	.56	.17	0	0	.01	.0
Miscellaneous 4/	.30	.16	0	0	.30	.16	.01	.0
Not used	.23	4.50	.12	.06	.11	4.44	.28	3.2
Total	1.11	12.51	.70	7.91	.41	4.60	.30	3.2
Lake								
Fiber products	0	9.19	0	9.19	0	0	0	1.9
Miscellaneous 4/	0	5.57	0	.14	0	5.43	0	2.0
Total	0	14.76	0	9.33	0	5.43	0	3.9
Leelanau								
Fiber products	.03	.60	.03	.60	0	0	0	
Domestic fuel	.04	.25	.04	.25	0	0	0	
Miscellaneous 4/	.02	.35	0	0	.02	.35	.01	.2
Not used	.02	.15	0	0	.02	.15	.02	.0
Total	.11	1.35	.07	.85	.04	.50	.03	.3
Manistee								
Fiber products	.29	2.38	.29	2.38	0	0	0	
Domestic fuel	0	.80	0	.80	0	0	0	.3
Miscellaneous 4/	.04	.72	0	0	.04	.72	0	
Not used	.13	1.13	0	0	.13	1.13	.12	.9
Total	.46	5.03	.29	3.18	.17	1.85	.12	1.3

(Table 20 continued on next page)

(Table 20 continued)

NORTHERN LOWER PENINSULA

ity and of use	Wood residue							
	Total		Coarse 1/		Fine 2/		Bark 3/	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
on								
ber products	.28	5.26	.28	5.26	0	0	0	0
dustrial fuel	0	.11	0	.11	0	0	0	.02
mestic fuel	0	1.92	0	1.92	0	0	0	.46
scellaneous 4/	.16	4.35	0	0	.16	4.35	.06	1.07
t used	0	2.31	0	1.53	0	.78	.06	2.11
Total	.44	13.95	.28	8.82	.16	5.13	.12	3.66
sta								
ber products	0	1.03	0	1.03	0	0	0	0
mestic fuel	0	2.59	0	2.59	0	0	0	.28
scellaneous 4/	0	1.95	0	0	0	1.95	0	1.27
t used	0	.15	0	0	0	.15	0	0
Total	0	5.72	0	3.62	0	2.10	0	1.55
and								
ber products	.07	2.94	.07	2.94	0	0	0	0
dustrial fuel	.04	.98	.04	.98	0	0	0	0
mestic fuel	.04	3.39	.04	3.39	0	0	0	.36
scellaneous 4/	.04	3.03	0	0	.04	3.03	0	.36
t used	.04	1.23	0	0	.04	1.23	.06	2.39
Total	.23	11.57	.15	7.31	.08	4.26	.06	3.11
aukee								
ber products	.40	3.62	.40	3.62	0	0	.17	1.54
mestic fuel	.06	.09	.06	.09	0	0	0	0
scellaneous 4/	.27	2.15	0	0	.27	2.15	0	0
t used	0	0	0	0	0	0	.02	.04
Total	.73	5.86	.46	3.71	.27	2.15	.19	1.58
morency								
ber products	0	2.25	0	2.25	0	0	0	0
mestic fuel	.20	.06	.20	.06	0	0	.07	.06
scellaneous 4/	.20	.73	0	0	.20	.73	0	.06
t used	.33	9.12	.26	5.37	.07	3.75	.27	3.12
Total	.73	12.16	.46	7.68	.27	4.48	.34	3.24
aygo								
ber products	0	4.80	0	4.80	0	0	0	0
mestic fuel	.18	6.60	.18	6.60	0	0	.08	3.05
scellaneous 4/	.11	3.80	0	0	.11	3.80	0	1.80
t used	0	3.67	0	.52	0	3.15	0	.23
Total	.29	18.87	.18	11.92	.11	6.95	.08	5.08
ana								
ber products	0	.75	0	.75	0	0	0	0
dustrial fuel	0	.20	0	.20	0	0	0	0
mestic fuel	.17	2.93	.17	2.93	0	0	.07	1.33
scellaneous 4/	.12	2.36	.04	.24	.08	2.12	.02	.35
t used	.04	1.25	0	.44	.04	.81	0	.31
Total	.33	7.49	.21	4.56	.12	2.93	.09	1.99
maw								
ber products	.17	4.62	.17	4.62	0	0	0	0
dustrial fuel	.09	1.23	.09	.77	0	.46	0	.16
mestic fuel	.03	2.05	.03	2.05	0	0	.01	.70
scellaneous 4/	.13	3.57	0	.60	.13	2.97	0	1.03
t used	.20	1.99	.10	.47	.10	1.52	.16	1.73
Total	.62	13.46	.39	8.51	.23	4.95	.17	3.62

(Table 20 continued on next page)

(Table 20 continued)

NORTHERN LOWER PENINSULA

County and type of use	Wood residue: Total		Coarse 1/		Fine 2/		Bark 3/	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwo
Osceola								
Fiber products	.39	8.28	.39	8.28	0	0	.16	3.
Industrial fuel	0	.01	0	.01	0	0	0	.
Domestic fuel	0	3.45	0	3.45	0	0	0	1.
Miscellaneous 4/	0	1.91	0	0	0	1.91	0	.
Not used	.22	5.09	0	.10	.22	4.99	0	.
Total	.61	18.74	.39	11.84	.22	6.90	.16	4.
Oscoda								
Fiber products	18.63	2.11	18.63	2.11	0	0	0	
Industrial fuel	.02	.10	.02	.10	0	0	.01	.
Domestic fuel	.17	2.52	.17	2.52	0	0	.08	1.
Miscellaneous 4/	5.47	1.70	0	0	5.47	1.70	0	
Not used	7.65	7.29	1.37	3.94	6.28	3.35	8.51	2.
Total	31.94	13.72	20.19	8.67	11.75	5.05	8.60	3.
Otsego								
Not used	0	3.18	0	2.01	0	1.17	0	.
Total	0	3.18	0	2.01	0	1.17	0	.
Presque isle								
Domestic fuel	0	.05	0	.05	0	0	0	.
Miscellaneous 4/	.01	0	0	0	.01	0	0	
Not used	.10	.13	.07	.06	.03	.07	.85	.
Total	.11	.18	.07	.11	.04	.07	.85	.
Roscommon								
Fiber products	.63	9.38	.63	9.38	0	0	0	
Industrial fuel	.20	.80	.20	.80	0	0	0	
Domestic fuel	.30	1.71	.30	1.71	0	0	0	.
Miscellaneous 4/	.64	8.55	0	2.01	.64	6.54	.05	3.
Not used	.03	1.59	0	.03	.03	1.56	.44	2.
Total	1.80	22.03	1.13	13.93	.67	8.10	.49	5.
Wexford								
Fiber products	1.00	3.15	1.00	3.15	0	0	0	
Industrial fuel	0	.03	0	.03	0	0	0	
Domestic fuel	.98	.14	.98	.14	0	0	0	
Miscellaneous 4/	1.03	.55	0	0	1.03	.55	.75	.
Not used	.12	1.60	0	.13	.12	1.47	0	.
Total	3.13	5.47	1.98	3.45	1.15	2.02	.75	1.
All counties								
Fiber products	28.98	125.79	28.98	125.79	0	0	.36	8.
Industrial fuel	1.16	15.44	1.05	12.11	.11	3.33	.08	2.
Domestic fuel	5.54	55.96	5.54	55.96	0	0	.33	13.
Miscellaneous 4/	12.05	77.86	.24	6.80	11.81	71.06	6.05	39.
Not used	13.11	72.47	2.64	17.86	10.47	54.61	12.30	29.
Total	60.84	347.52	38.45	218.52	22.39	129.00	19.12	92.

(Table 20 continued on next pag

(Table 20 continued)

SOUTHERN LOWER PENINSULA

...ty and ... of use	Wood residue							
	Total		Coarse 1/		Fine 2/		Bark 3/	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
...egan								
...ndustrial fuel	0	.01	0	.01	0	0	0	.01
...omestic fuel	0	1.24	0	1.24	0	0	0	.47
...iscellaneous 4/	0	.73	0	0	0	.73	0	.05
Total	0	1.98	0	1.25	0	.73	0	.53
...y								
...iber products	0	20.33	0	20.33	0	0	0	0
...iscellaneous 4/	0	5.92	0	0	0	5.92	0	8.65
...ot used	0	5.92	0	0	0	5.92	0	0
Total	0	32.17	0	20.33	0	11.84	0	8.65
...rien								
...ndustrial fuel	0	.14	0	0	0	.14	0	0
...iscellaneous 4/	0	.40	0	.04	0	.36	0	.12
...ot used	0	.48	0	.48	0	0	0	.15
Total	0	1.02	0	.52	0	.50	0	.27
...nch								
...iber products	0	5.55	0	5.55	0	0	0	0
...iscellaneous 4/	0	3.23	0	0	0	3.23	0	2.34
Total	0	8.78	0	5.55	0	3.23	0	2.34
...houn								
...ndustrial fuel	0	.02	0	.02	0	0	0	.01
...omestic fuel	0	.02	0	.02	0	0	0	0
...iscellaneous 4/	0	.01	0	0	0	.01	0	.01
...ot used	0	.02	0	0	0	.02	0	0
Total	0	.07	0	.04	0	.03	0	.02
...s								
...ndustrial fuel	0	2.77	0	2.77	0	0	0	0
...iscellaneous 4/	0	1.61	0	0	0	1.61	0	1.15
...ot used	0	1.68	0	1.06	0	.62	0	.44
Total	0	6.06	0	3.83	0	2.23	0	1.59
...nton								
...iber products	0	5.72	0	5.72	0	0	0	0
...iscellaneous 4/	0	3.33	0	0	0	3.33	0	2.40
Total	0	9.05	0	5.72	0	3.33	0	2.40
...on								
...iber products	0	5.56	0	5.56	0	0	0	0
...ndustrial fuel	0	4.09	0	.60	0	3.49	0	1.77
...omestic fuel	0	.05	0	.05	0	0	0	0
...iscellaneous 4/	0	.12	0	0	0	.12	0	.85
Total	0	9.82	0	6.21	0	3.61	0	2.62
...esee								
...iber products	0	.91	0	.91	0	0	0	0
...omestic fuel	0	.23	0	.23	0	0	0	.24
...iscellaneous 4/	0	.53	0	0	0	.53	0	.24
...ot used	0	.13	0	0	0	.13	0	0
Total	0	1.80	0	1.14	0	.66	0	.48
...atiot								
...iber products	0	.99	0	.99	0	0	0	0
...omestic fuel	0	.25	0	.25	0	0	0	.26
...iscellaneous 4/	0	.57	0	0	0	.57	0	.26
...ot used	0	.14	0	0	0	.14	0	0
Total	0	1.95	0	1.24	0	.71	0	.52

(Table 20 continued on next page)

(Table 20 continued)

SOUTHERN LOWER PENINSULA

County and type of use	Wood residue							
	Total		Coarse 1/		Fine 2/		Bark 3/	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Hillsdale								
Miscellaneous 4/	0	.01	0	0	0	.01	0	
Not used	0	.01	0	.01	0	0	0	
Total	0	.02	0	.01	0	.01	0	
Huron								
Fiber products	0	.40	0	.40	0	0	0	
Industrial fuel	0	3.59	0	3.59	0	0	0	
Domestic fuel	0	3.69	0	3.69	0	0	0	
Miscellaneous 4/	0	4.41	0	0	0	4.41	0	3
Not used	0	.06	0	0	0	.06	0	
Total	0	12.15	0	7.68	0	4.47	0	3
Ingham								
Fiber products	0	8.35	0	8.35	0	0	0	
Domestic fuel	0	2.77	0	2.77	0	0	0	
Miscellaneous 4/	0	6.45	0	0	0	6.45	0	4
Not used	0	.03	0	0	0	.03	0	
Total	0	17.60	0	11.12	0	6.48	0	4
Ionia								
Fiber products	0	11.39	0	11.39	0	0	0	
Industrial fuel	0	.27	0	.27	0	0	0	
Domestic fuel	0	3.11	0	3.11	0	0	0	
Miscellaneous 4/	0	8.54	0	0	0	8.54	0	5
Not used	0	.05	0	0	0	.05	0	
Total	0	23.36	0	14.77	0	8.59	0	6
Jackson								
Not used	0	.29	0	.18	0	.11	0	
Total	0	.29	0	.18	0	.11	0	
Kalamazoo								
Industrial fuel	0	.04	0	.04	0	0	0	
Domestic fuel	0	.10	0	.10	0	0	0	
Miscellaneous 4/	0	.13	0	0	0	.13	0	
Total	0	.27	0	.14	0	.13	0	
Kent								
Fiber products	.04	17.58	.04	17.58	0	0	0	4
Domestic fuel	0	.17	0	.17	0	0	0	
Miscellaneous	.03	10.27	0	0	.03	10.27	.02	2
Not used	0	.08	0	0	0	.08	0	
Total	.07	28.10	.04	17.75	.03	10.35	.02	7
Lapeer								
Fiber products	0	.40	0	.40	0	0	0	
Industrial fuel	0	.02	0	.02	0	0	0	
Domestic fuel	0	.18	0	.18	0	0	0	
Miscellaneous 4/	0	.55	0	0	0	.55	0	
Not used	0	.67	0	.55	0	.12	0	
Total	0	1.82	0	1.15	0	.67	0	
Lenawee								
Fiber products	0	8.32	0	8.32	0	0	0	
Industrial fuel	0	.05	0	.05	0	0	0	
Miscellaneous 4/	0	6.67	0	1.14	0	5.53	0	3
Total	0	15.04	0	9.51	0	5.53	0	4

(Table 20 continued on next p

(Table 20 continued)

SOUTHERN LOWER PENINSULA

...ty and ...e of use	Wood residue							
	Total		Coarse 1/		Fine 2/		Bark 3/	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
...roe								
...omestic fuel	0	1.56	0	1.56	0	0	0	0
...iscellaneous 4/	0	.91	0	0	0	.91	0	.67
Total	0	2.47	0	1.56	0	.91	0	.67
...calm								
...iber products	0	.54	0	.54	0	0	0	0
...ndustrial fuel	0	.11	0	.11	0	0	0	.05
...omestic fuel	0	3.41	0	3.41	0	0	0	.21
...iscellaneous 4/	0	2.17	0	0	0	2.17	0	1.04
...ot used	0	.90	0	.45	0	.45	0	.61
Total	0	7.13	0	4.51	0	2.62	0	1.91
...kegon								
...iber products	.09	1.30	.09	1.30	0	0	0	0
...ndustrial fuel	0	.45	0	.45	0	0	0	.19
...omestic fuel	.09	1.34	.09	1.34	0	0	0	.02
...iscellaneous 4/	0	.26	0	0	0	.26	.08	1.10
...ot used	.11	1.84	0	.21	.11	1.63	0	.07
Total	.29	5.19	.18	3.30	.11	1.89	.08	1.38
...land								
...iber products	0	.64	0	.64	0	0	0	0
...omestic fuel	0	1.27	0	1.27	0	0	0	.17
...iscellaneous 4/	0	1.02	0	0	0	1.02	0	.64
...ot used	0	.09	0	0	0	.09	0	0
Total	0	3.02	0	1.91	0	1.11	0	.81
...awa								
...omestic fuel	.18	.91	.18	.91	0	0	.08	.39
...iscellaneous 4/	0	.53	0	0	0	.53	0	0
...ot used	.11	.01	0	0	.11	.01	0	0
Total	.29	1.45	.18	.91	.11	.54	.08	.39
...inaw								
...iber products	0	1.76	0	1.76	0	0	0	0
...omestic fuel	0	2.79	0	2.79	0	0	0	.47
...iscellaneous 4/	0	2.12	0	0	0	2.12	0	.47
...ot used	0	.53	0	0	0	.53	0	1.00
Total	0	7.20	0	4.55	0	2.65	0	1.94
...Clair								
...iber products	0	.74	0	.74	0	0	0	0
...omestic fuel	0	1.27	0	1.27	0	0	0	.20
...iscellaneous 4/	0	3.16	0	.92	0	2.24	0	.20
...ot used	0	1.47	0	1.26	0	.21	0	1.39
Total	0	6.64	0	4.19	0	2.45	0	1.79
...awassee								
...iber products	0	.59	0	.59	0	0	0	0
...omestic fuel	0	.15	0	.15	0	0	0	.16
...iscellaneous 4/	0	.34	0	0	0	.34	0	.16
...ot used	0	.09	0	0	0	.09	0	0
Total	0	1.17	0	.74	0	.43	0	.32
...cola								
...iber products	0	2.56	0	2.56	0	0	0	0
...ndustrial fuel	0	.06	0	.06	0	0	0	.02
...omestic fuel	.01	1.33	.01	1.33	0	0	0	.65
...iscellaneous 4/	0	1.92	0	0	0	1.92	0	1.00
...ot used	0	.65	0	.17	0	.48	0	.07
Total	.01	6.52	.01	4.12	0	2.40	0	1.74

(Table 20 continued on next page)

(Table 20 continued)

SOUTHERN LOWER PENINSULA

County and type of use	Wood residue							
	Total		Coarse 1/		Fine 2/		Bark 3/	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Van Buren								
Industrial fuel	.05	.38	.03	.24	.02	.14	.01	.40
Miscellaneous 4/	0	.46	0	.29	0	.17	0	.13
Not used	0	1.10	0	.43	0	.67	0	0
Total	.05	1.94	.03	.96	.02	.98	.01	.53
Washtenaw								
Domestic fuel	0	.97	0	.97	0	0	0	0
Miscellaneous 4/	0	.38	0	0	0	.38	0	.27
Not used	0	.41	0	.14	0	.27	0	.20
Total	0	1.76	0	1.11	0	.65	0	.47
All counties								
Fiber products	.13	93.63	.13	93.63	0	0	0	4.72
Industrial fuel	.05	12.00	.03	8.23	.02	3.77	.01	2.62
Domestic fuel	.28	26.81	.28	26.81	0	0	.08	4.05
Miscellaneous 4/	.03	66.75	0	2.39	.03	64.36	.10	41.59
Not used	.22	16.65	0	4.94	.22	11.71	0	4.70
Total	.71	215.84	.44	136.00	.27	79.84	.19	57.68
Total Michigan								
Fiber products	52.24	346.96	52.24	346.96	0	0	.36	12.90
Industrial fuel	20.97	105.65	8.68	52.54	12.29	53.11	7.98	36.61
Domestic fuel	14.33	104.64	14.33	104.64	0	0	3.14	21.92
Miscellaneous 4/	17.58	200.94	.24	24.63	17.34	176.31	11.01	98.64
Not used	23.28	145.17	5.64	26.68	17.64	118.49	16.88	69.16
Total	128.40	903.36	81.13	555.45	47.27	347.91	39.37	239.23

1/ Suitable for chipping such as slabs, edgings, veneer cores, etc.
2/ Not suitable for chipping such as sawdust, veneer clippings, etc.
3/ Does not include bark at pulpmills and particleboard plants.
4/ Livestock bedding, mulch, small dimension, and specialty items.

U S Government Printing Office: 1981 —766-876/189 Region No. 6

Blyth, James E., Jack Zollner, and W. Brad Smith.

1981. Primary forest products industry and timber use, Michigan, 1977. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-55, 54 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

Discusses recent Michigan forest industry trends, timber removals for industrial roundwood in 1977, and production and receipts of pulpwood, saw logs, and other industrial roundwood products. Reports on associated logging and primary mill residues and the disposition of mill residue.

KEY WORDS: Pulpwood, saw logs, production, logging residue, mill residue, timber removals.

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Pulpwood Production

in the North-Central Region by County, 1979

James E. Blyth and W. Brad Smith

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Manuscript approved for publication September 22, 1980
1981

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HIGHLIGHTS

Lake States

For the first time, logs, bolts, and wood residue used in manufacturing particleboard and waferboard are included in this annual series.

Lake States pulpwood production was 5.55 million cords in 1979 (table 1). Major production gains were in white birch, hard maple, and soft maple. Pine production reached a new high supported by a 13-percent rise in the red pine harvest. Whole tree chips accounted for 7 percent of the pulpwood; Michigan was the leading producer.

Michigan and Wisconsin loggers cut record amounts of pine and birch. Wisconsin provided three-fifths of the red pine cut in the Lake States. In Minnesota, the pine harvest fell to a new modern low.

Wisconsin was the major purchaser of Canadian softwood residue which was imported into the Lake States at record levels for the seventh consecutive year.

In Minnesota, three waferboard plants are being built and one is tripling its capacity. When this construction is completed, composition board capacity is likely to double in the Lake States.

Central States

Pulpwood production was 476,000 cords, up 11 percent from 1978 and second only to the record output in 1974. Record high exports were half of the total production. Indiana and Iowa broke previous pulpwood production records.

Pulpwood receipts rose 15 percent to 295,000 cords. Imports (19 percent of all receipts) came from 15 States.

PULPWOOD PRODUCTION IN THE NORTH CENTRAL REGION, BY COUNTY, 1979

James E. Blyth, *Principal Market Analyst,*
and **W. Brad Smith,** *Associate Mensurationist*

This is the 21st annual report of the pulpwood harvest in Lake States counties and the 20th annual report of the Central States harvest. Pulpwood constitutes more than half the timber products harvested annually in the Lake States (Michigan, Minnesota, and Wisconsin) and is an important product in the Central States (Illinois, Indiana, Iowa, and Missouri).

Current detailed pulpwood production[1] information is necessary for intelligent planning and decisionmaking in wood procurement, forest resource management, and forest industry development. Also, researchers need current pulpwood information for project planning.

For the first time, logs, bolts and wood residue used in manufacturing particleboard and waferboard are included in this annual series. Wood used at composition board plants is identical or nearly identical to wood used at pulpmills.

Because composition board plants primarily use aspen and wood residue, it is possible both to analyze roundwood use trends for other species and to compare survey results with 1978 without large distortions from initial inclusion of these board plants in 1979.

Pulpmills, particleboard plants, and waferboard plants using North Central States timber in 1979 reported their pulpwood receipts[2] by species groups and counties of origin. This report presents the results of the survey, analyzes the data where appropriate, compares results with 1978 or earlier years, and discusses trends in pulpwood production and use.

The Lake States and Central States are discussed separately because the forest types in each area are different and less information can be released about the Central States (more detailed data on pulpwood production and receipts in the Central States would reveal the operations of individual mills).

Pulpwood production in Minnesota is completely and accurately shown. However, to prevent disclosure of confidential information about softwood pulpwood use by individual companies, the total quantity of softwood pulpwood imports and exports between Minnesota and Canada are not reported. Thus, some Minnesota softwood shipped to Canada is shown as remaining and used in Minnesota, and receipts of Canadian softwood in Minnesota are understated.

LAKE STATES

Production

Pulpwood production reached 5.55 million cords in the Lake States in 1979. Roundwood (including chips from roundwood) continued to provide 9 out of 10 cords; the remainder was residue from local wood-using plants.[3]

Major species harvested were aspen (2,298,000 cords) and jack pine (599,000 cords). Other important species, each providing between 200,000 and 300,000 cords, were balsam fir, red pine, soft maple, white birch, hard maple, and spruce.

[1] *Pulpwood production, determined from mill receipts, is the annual volume of pulpwood cut in a specific county or region, plus the annual wood residue volume produced by sawmills, veneer mills, etc., in a specific State or region that was used for pulp manufacturing.*

[2] *Pulpwood receipts are the volume of wood received by mills in a specific State or region, regardless of the geographic source.*

[3] *Residue is the byproduct from sawmills, veneer mills, cooperage mills, and other wood-using plants that is used for pulping. Residue includes slabs, edgings, veneer cores, sawdust, wood flour, and chips manufactured from slabs, edgings, and veneer cores.*

Table 1.--Production and imports of pulpwood, Lake States, 1979

(In standard cords, unpeeled)

Species and destination	Production by States[1/]				Imports			
	Michigan	Minnesota	Wisconsin	Regional total	Other U.S.[2/]	Canada	Total imports	Total receipts
Cedar								
Michigan	8,175	0	367	8,542	0	0	0	8,542
Total	8,175	0	367	8,542	0	0	0	8,542
Balsam fir								
Michigan	43,378	0	3,804	47,182	0	0	0	47,182
Minnesota	0	108,908	307	109,215	0	0	0	109,215
Wisconsin	33,811	936	80,113	114,860	0	100	100	114,960
Exported[3/]	8,100	7,591	0	15,751	0	0	0	0
Total	85,289	117,435	84,284	287,008	0	100	100	271,357
Hemlock								
Michigan	39,126	0	6,646	45,772	0	0	0	45,772
Wisconsin	5,780	0	33,082	38,862	0	0	0	38,862
Total	44,906	0	39,728	84,634	0	0	0	84,634
Jack pine								
Michigan	145,932	0	1,665	147,597	0	0	0	147,597
Minnesota	0	110,345	0	110,345	0	3,105	3,105	113,450[5/]
Wisconsin	113,484	22,700	196,330	332,514	54,347[4/]	345	54,692[5/]	387,206[5/]
Exported[3/]	4,001	5,024	0	9,025	0	0	0	0
Total	263,417	138,069	197,995	599,481	54,347	3,450	57,797	648,253
Red pine								
Michigan	68,082	0	953	69,035	0	0	0	69,035
Minnesota	0	11,135	0	11,135	0	0	0	11,135
Wisconsin	9,737	4,378	142,367	156,482	138	0	138	156,620
Total	77,819	15,513	143,320	236,652	138	0	138	236,790
White pine								
Michigan	5,060	0	511	5,571	0	0	0	5,571
Minnesota	0	4,892	0	4,892	0	0	0	4,892
Wisconsin	3,699	21	19,304	23,024	87	0	87	23,111
Total	8,759	4,913	19,815	33,487	87	0	87	33,574
Spruce								
Michigan	12,100	0	700	12,800	0	0	0	12,800
Minnesota	0	126,302	244	126,546	0	4,830	4,830	131,376
Wisconsin	16,314	21,517	18,189	56,020	56	20,192	20,248	76,268
Exported[3/]	10,272	4,970	0	15,242	0	0	0	0
Total	38,686	152,789	19,133	210,608	56	25,022	25,078	220,444
Tamarack								
Michigan	1,766	0	124	1,890	0	0	0	1,890
Minnesota	0	17,354	0	17,354	0	79	79	17,433
Wisconsin	605	18,421	1,382	20,408	0	223	223	20,631
Total	2,371	35,775	1,506	39,652	0	302	302	39,954
Ash								
Michigan	9,479	0	0	9,479	0	0	0	9,479
Minnesota	0	559	0	559	0	0	0	559
Wisconsin	5,541	464	32,110	38,115	0	0	0	38,115
Exported[3/]	0	68	0	68	0	0	0	0
Total	15,020	1,091	32,110	48,221	0	0	0	48,153
Aspen								
Michigan	525,785	0	919	526,704	0	0	0	526,704
Minnesota	36	717,016	15,379	732,431	0	594	594	733,025
Wisconsin	183,358	82,970	733,014	999,342	0	0	0	999,342
Exported[3/]	221	37,609	1,407	39,237	0	0	0	0
Total	709,400	837,595	750,719	2,297,714	0	594	594	2,259,071
Balsam poplar								
Michigan	21,936	0	117	22,053	0	0	0	22,053
Minnesota	0	24,510	0	24,510	0	0	0	24,510
Exported[3/]	0	679	0	679	0	0	0	0
Total	21,936	25,189	117	47,242	0	0	0	46,563
Basswood								
Michigan	6,171	0	3	6,174	0	0	0	6,174
Minnesota	0	512	0	512	0	0	0	512
Wisconsin	120	0	14,775	14,895	0	0	0	14,895
Exported[3/]	0	49	551	600	0	0	0	0
Total	6,291	561	15,329	22,181	0	0	0	21,581
Beech								
Michigan	16,325	0	85	16,410	0	0	0	16,410
Wisconsin	461	0	12	473	0	0	0	473
Total	16,786	0	97	16,883	0	0	0	16,883
White birch								
Michigan	73,214	0	312	73,526	0	0	0	73,526
Minnesota	0	3,207	0	3,207	0	0	0	3,207
Wisconsin	7,743	3,188	127,838	138,769	0	0	0	138,769
Exported[3/]	0	262	217	479	0	0	0	0
Total	80,957	6,657	128,367	215,981	0	0	0	215,502
Yellow birch								
Michigan	11,163	0	71	11,234	0	0	0	11,234
Wisconsin	16,449	8	22,888	39,345	0	0	0	39,345
Total	27,612	8	22,959	50,579	0	0	0	50,579
Cottonwood								
Exported[3/]	0	0	93	93	0	0	0	0
Total	0	0	93	93	0	0	0	0
Elm								
Michigan	7,442	0	23	7,465	0	0	0	7,465
Minnesota	0	1,038	0	1,038	0	0	0	1,038
Wisconsin	23,639	72	117,449	141,160	0	0	0	141,160
Exported[3/]	0	194	1,698	1,892	0	0	0	0
Total	31,081	1,304	119,170	151,555	0	0	0	149,663

(Table 1 continued on next page)

(Table 1 continued)

Species and destination	Production by States 1/				Imports			
	Michigan	Minnesota	Wisconsin	Regional total	Other U.S. 2/	Canada	Total imports	Total receipts
Hickory								
Wisconsin	0	0	438	438	0	0	0	438
Total	0	0	438	438	0	0	0	438
Hard maple								
Michigan	44,203	0	197	44,400	0	0	0	44,400
Wisconsin	57,268	482	110,753	168,503	0	0	0	168,503
Exported 3/	0	191	0	191	0	0	0	0
Total	101,471	673	110,950	213,094	0	0	0	212,903
Soft maple								
Michigan	126,709	0	331	127,040	0	0	0	127,040
Minnesota	0	482	0	482	0	0	0	482
Wisconsin	21,863	480	77,611	99,954	0	0	0	99,954
Exported 3/	0	6	2,316	2,322	0	0	0	0
Total	148,572	968	80,258	229,798	0	0	0	227,476
Red oak								
Michigan	92,148	0	5	92,153	0	0	0	92,153
Minnesota	0	963	0	963	0	0	0	963
Wisconsin	1,681	178	52,926	54,785	0	0	0	54,785
Exported 3/	0	137	1,842	1,979	0	0	0	0
Total	93,829	1,278	54,773	149,880	0	0	0	147,901
White oak								
Michigan	11,757	0	0	11,757	0	0	0	11,757
Wisconsin	7	74	21,922	22,003	0	0	0	22,003
Exported 3/	0	274	674	948	0	0	0	0
Total	11,764	348	22,596	34,708	0	0	0	33,760
Other hardwoods								
Michigan	6,170	0	19	6,189	0	0	0	6,189
Wisconsin	3,030	0	5,283	8,313	0	0	0	8,313
Total	9,200	0	5,302	14,502	0	0	0	14,502
Total roundwood								
Michigan	1,276,061	0	16,912	1,292,973	0	0	0	1,292,973
Minnesota	36	1,127,223	15,930	1,143,189	0	8,608	8,608	1,151,797
Wisconsin	504,590	155,889	1,807,786	2,468,265	54,628	20,860	75,488	2,543,753
Exported 3/	22,654	57,054	8,798	88,506	0	0	0	0
Total	1,803,341	1,340,166	1,849,426	4,992,933	54,628	29,468	84,096	4,988,523
Residue, softwood								
Michigan	11,003	0	267	11,270	0	1,586	1,586	12,856
Minnesota	0	32,825	0	32,825	27,697	5,847	33,544	66,369
Wisconsin	2,814	6,136	45,935	54,885	205,933	71,037	276,970	331,855
Exported 3/	1,493	3,743	2,321	7,557	0	0	0	0
Total	15,310	42,704	48,523	106,537	233,630	78,470	312,100	411,080
Residue, hardwood								
Michigan	140,756	0	29,548	170,304	13,815	0	13,815	184,119
Minnesota	0	66,263	4,522	70,785	864	4,095	4,959	75,744
Wisconsin	8,727	7,187	170,079	185,993	5,571	0	5,571	191,564
Exported 3/	13,050	1,743	6,574	21,367	0	0	0	0
Total	162,533	75,193	210,723	448,449	20,250	4,095	24,345	451,427
All wood material								
Michigan	1,427,820	0	46,727	1,474,547	13,815	1,586	15,401	1,489,948
Minnesota	36	1,226,311	20,452	1,246,799	28,561	18,550	47,111	1,293,910
Wisconsin	516,131	169,212	2,023,800	2,709,143	266,132	91,897	358,029	3,067,172
Exported 3/	37,197	62,540	17,693	117,430	0	0	0	0
Total	1,981,184	1,458,063	2,108,672	5,547,919	308,508	112,033	420,541	5,851,030

1/ Vertical columns of figures under box heading--production by States--present the amount of pulpwood cut in each State.
2/ Mostly western States.
3/ Pulpwood shipped to mills outside of region.
4/ Ponderosa pine.
5/ Includes ponderosa pine from other U.S.

Production climbed among many species with significant advances in white birch (41,000 cords), hard maple (39,000 cords), and soft maple (35,000 cords). Pine output reached a new high assisted by a 13-percent rise in red pine harvesting. Most of the red pine is cut in plantations that are mature enough to provide commercial thinnings. Birch harvesting rose to a new peak as the pulp industry continued to seek technological improvements for processing more of this underutilized species. Soft maple harvesting surpassed 200,000 cords for the first time.

Hemlock production fell 16,000 cords to the lowest point in more than 30 years. Spruce output plunged 15,000 cords, not far from its 30-year low.

Lake States loggers produced 382,000 cords of whole tree chips[4], 7 percent of the pulpwood from all sources. Production of whole tree chips by species group and State was:

State	Softwoods	Aspen	Other hardwoods
		Thousand cords	
Michigan	7.4	157.3	70.0
Minnesota	—	133.8	7.2
Wisconsin	—	6.8	—

Michigan.—Demand for Michigan pulpwood was 1.98 million cords. Michigan loggers cut record quantities of pine and birch—the jack pine harvest increased by 71,000 cords. Top-producing counties were Iron, Marquette, Menominee, and Delta.

Minnesota.—Minnesota's 1.46 million cord output was 57 percent aspen, 10 percent spruce, and 9 percent jack pine. Demand for Minnesota spruce and birch remained low. The pine cut fell beneath the previous modern day low set in 1949. Transportation

[4] *Pulpwood produced from chipping entire trees (all portions of trees above ground, except the stumps).*

costs are an important factor affecting demand for Minnesota pine. Four counties—St. Louis, Koochiching, Itasca, and Beltrami—furnished 65 percent of the roundwood from all species.

Wisconsin.—Wisconsin furnished 2.11 million cords and set new production highs for pine and birch. Red pine harvesting was particularly strong, accounting for three-fifths of the red pine pulpwood cut in the Lake States. Counties supplying more than 100,000 cords were Oneida, Marinette, Price, Forest, and Sawyer.

The distribution of the harvest is shown here in two ways: first, the amount of pulpwood cut relative to the growing stock volume in major pulpwood species (fig. 1); and second, the amount of pulpwood cut relative to commercial forest area (fig. 2). Harvesting was heavy in Central and Northeastern Wisconsin and most of Michigan other than the Southern Lower Peninsula.

Receipts

Forty pulpmills, three particleboard plants, and two waferboard plants acquired 5.85 million cords of pulpwood in 1979. Nine out of every 20 cords procured were aspen which was widely used in 41 of the 45 plants (table 2).

For the seventh consecutive year, Canada shipped record amounts of softwood residue to the Lake States, primarily to Wisconsin. Pulpwood imports from other States totaled 308,000 cords of which three-fourths was softwood residue primarily from South Dakota, Wyoming, Montana, and Colorado.

Michigan.—Michigan forests provided 96 percent of the 1.49 million cords received in the State. Less than 1,000 cords of aspen were imported. After aspen, the leading species procured were jack pine, soft maple, and red oak.

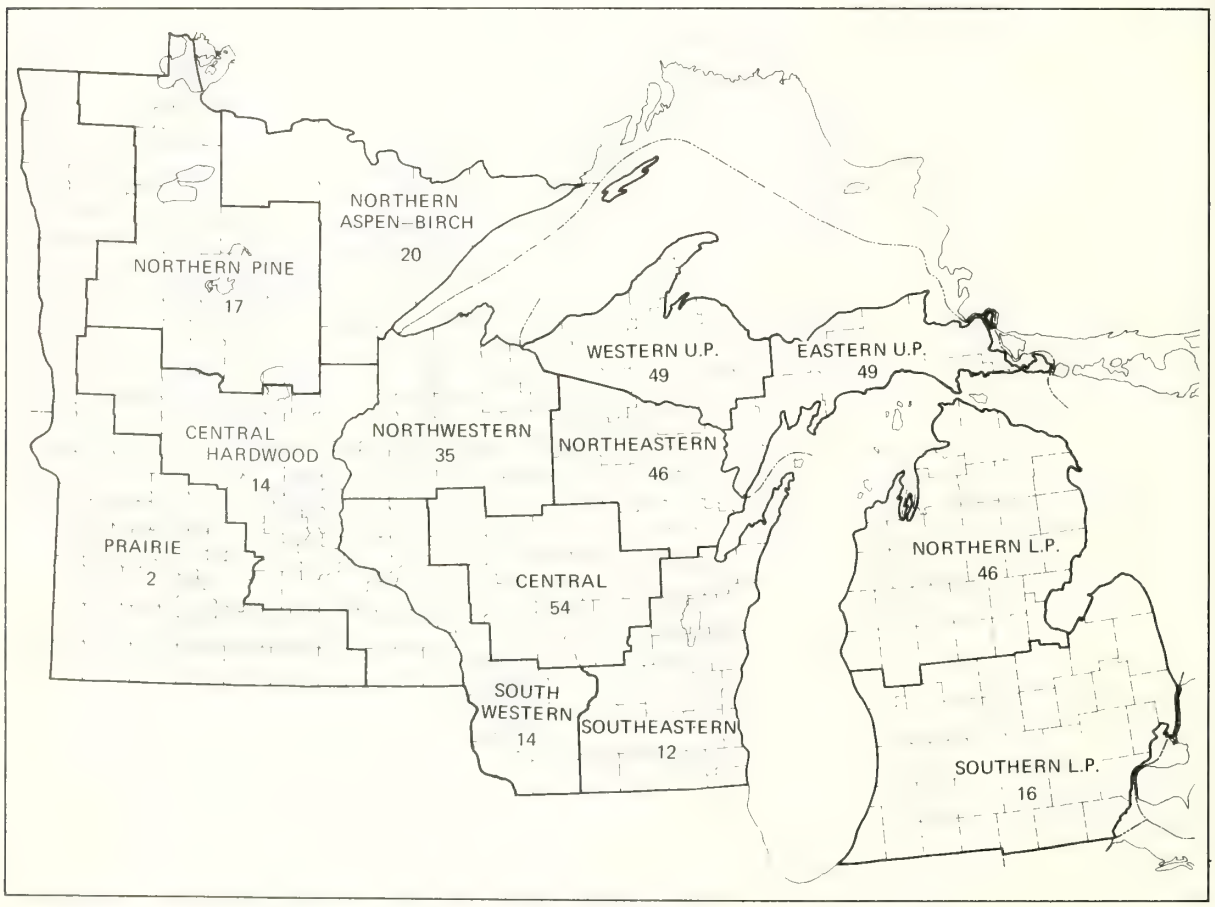


Figure 1.—*Cords of pulpwood bolts and logs harvested per 1,000 cords of merchantable volume in principal pulpwood species by Forest Inventory Unit, 1979. Merchantable volume was determined during the last forest inventory in each State.*

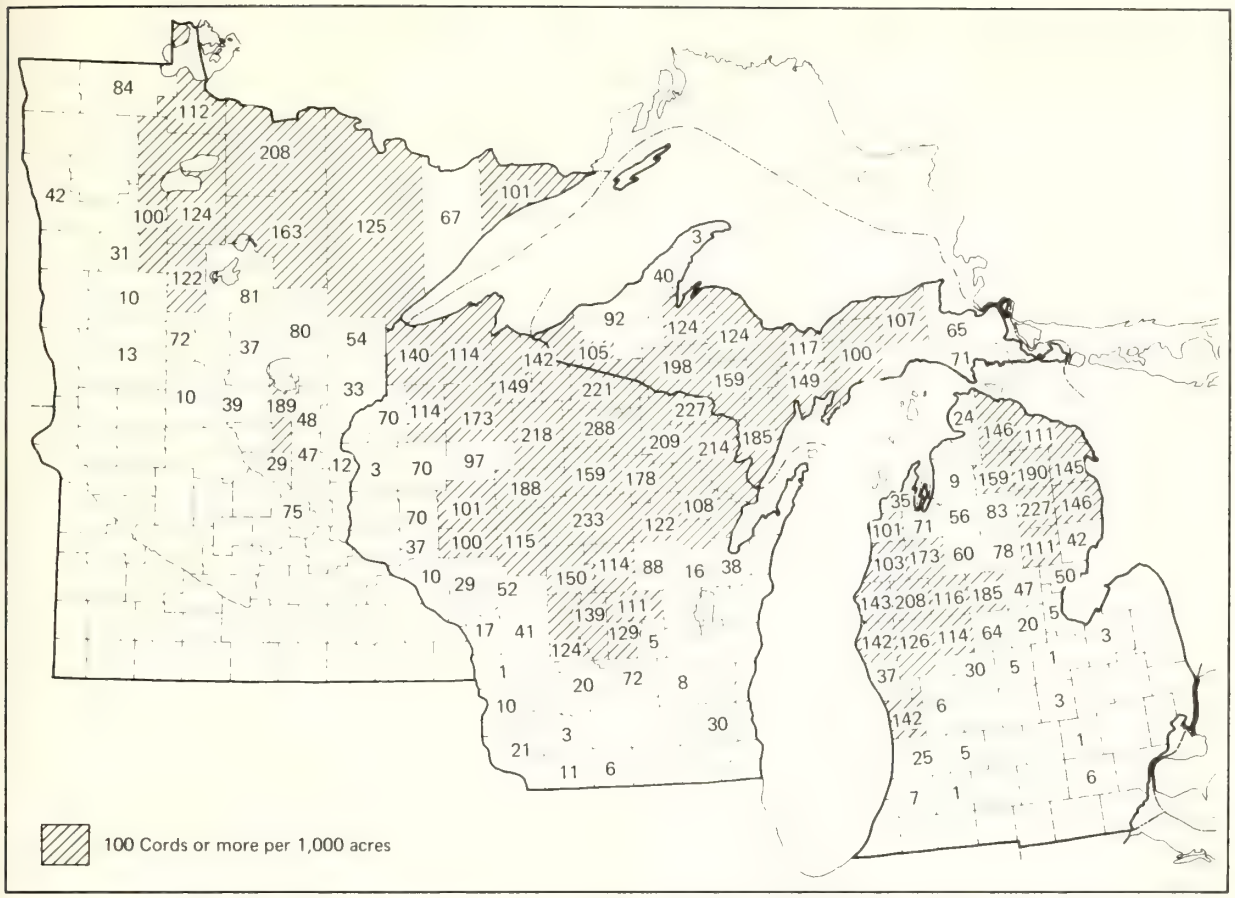


Figure 2.—*Cords of pulpwood cut per 1,000 acres of stocked commercial forest land in principal pulpwood-producing counties, 1979. Acres of stocked commercial forest land were determined during the last forest inventory in each State.*

Wisconsin.—Receipts were 3.07 million cords including 516,000 cords from Michigan, 169,000 cords from Minnesota, 266,000 cords from other (primarily western) States, and 92,000 cords from Canada. Principal imported species were jack pine, spruce, tamarack, aspen, and hard maple. Out-of-State sources supplied 86 percent of the softwood residue to Wisconsin mills.

Industry Trends and Analysis

Average daily pulp production fell slightly to 11,160 tons (table 3). Annual production capacity at particleboard and waferboard plants was 357 million square feet:

Company	Location	Capacity[5]
		Million square feet (¾-inch basis)
Champion International Corp.	Gaylord, MI	165
Blandin Wood Products Co.	Grand Rapids, MN	45
Publishers Paper Co.	Virginia, MN	15
Louisiana-Pacific Corp.	Hayward, WI	65
Weyerhaeuser Co.	Marshfield, WI	67

In 1979, the smallest particleboard plant in the Lake States closed permanently. However, in Minnesota, three waferboard plants are under construction and one is tripling its capacity. When these plants are completed, composition board capacity is likely to nearly double in the Lake States. Meanwhile, another waferboard plant is in the planning stage and several pulpmill expansions are underway or being planned.

[5]*Directory of the Forest Products Industry, 1980.*

Table 2.--Numbers of industrial plants in the Lake States using a particular species or residue for pulping and composition board in 1979

Species and kind of material	Total Lake States	Michigan	Minnesota	Wisconsin
Aspen	41	9	11	21
Balsam fir	16	4	5	7
Birch	20	6	1	13
Hemlock	7	1	--	6
Pine	9	3	2	4
Spruce	15	2	5	8
Tamarack	9	1	2	6
Maple	17	7	1	9
Oak	15	7	1	7
Other hardwoods	22	7	5	10
Softwood residue	14	2	3	9
Hardwood residue	19	7	4	8
Total plants[1/]	45	9	11	25

[1/] Some plants use more than one species, so numbers in columns cannot be added.

Based on 3-year running averages, birch pulpwood production has increased annually by 9.7 percent between 1969 and 1978, other hardwoods (excluding aspen and birch) by 6.8 percent, balsam fir by 6.3 percent, pine by 2.2 percent, while spruce has decreased annually by 0.1 percent (table 4). Between 1969 and 1974, spruce output had average annual increases of 4.2 percent but has declined annually since 1974 by 5.2 percent.

The trend in birch harvesting is encouraging because birch is greatly underutilized from a sustained yield viewpoint. Salvage of budworm-damaged balsam fir was a major reason for the increased harvests of fir.

CENTRAL STATES

Production

Pulpwood production rose 11 percent to 476,000 cords in 1979, the second highest production ever recorded (table 5). Hard hardwoods and hardwood residue accounted for most of the gain. Exports from the Central States reached a record high; half of the total production was shipped to Kentucky, Ohio, Minnesota, Wisconsin, and Michigan. Hardwood residue was the dominant export.

Indiana, the top producer, and Iowa produced mo pulpwood than in any other year. Hardwood resid was the major pulpwood component in Indiana; s hardwood was the leading component in Iow Illinois and Missouri had stable production.

Loggers cut pulpwood in 35 counties in Illinois, in Indiana, 19 in Missouri, and 14 in Iowa (fig. Logging territories expanded in east central a southern Illinois, south central Indiana and nort western Missouri, and contracted in southeaste Missouri.

Receipts

Pulpwood receipts at 12 Central States pulpmil climbed 15 percent to 295,000 cords in 1979. A roundwood and residue species groups contributed the advance. Imports were 19 percent of the tot receipts; imports by Illinois mills rose 86 percent an were one-third of their receipts. Fifteen State primarily Lake and southern States, shipped wood t the Central States.

Industry Trends and Analysis

Average daily pulp production remained at 1,15 tons per day (table 6). Mill ownership remained th

Table 3.--Active woodpulp mills in the Lake States, by location, type of pulp produced, and average daily production, 1979

(In tons per 24 hours)[1/]

Company	Location	Total	Average production			
			Sulfite	Kraft	Groundwood and other mechanical	Semi-chemical
Michigan:						
Abitibi Corp.	Alpena	430	0	0	430	0
Celotex Corp.	L'Anse	270	0	0	270	0
Champion International	Ontonagon	440	0	0	0	440
Manistique Pulp and Paper Co.	Manistique	90	0	0	90	0
Mead Corp.	Escanaba	750	0	600	150	0
Menasha Corp.	Otsego	225	0	0	0	225
Packaging Corp.of America	Filer City	600	0	0	0	600
Warren Co., S.D.	Muskegon	250	0	250	0	0
Total.....	8 Plants.....	3,055	0	850	940	1,265
Minnesota:						
Blandin Paper co.	Grand Rapids	325	0	0	325	0
Hennepin Paper Co.	Little Falls	75	0	0	75	0
Boise Cascade Corp.	International Falls	880	0	340	540	0
Potlatch Corp.	Cloquet	440	0	440	0	0
Superwood Corp.	Bemidji	90	0	0	90	0
St.Regis Paper Co.	Sartell	135	0	0	135	0
Superwood Corp.	Duluth	350	0	0	350	0
Champion International	St. Paul	300	0	0	0	300
Conwed Corp.	Cloquet	350	0	0	350	0
Total.....	9 Plants.....	2,945	0	780	1,865	300
Wisconsin:						
American Can Co.	Green Bay	210	150	0	60	0
Weyerhaeuser Co.	Rothschild	210	210	0	0	0
Badger Paper Mills	Peshtigo	110	110	0	0	0
Appleton Papers Inc.	Combined locks	200	0	0	200	0
Consolidated Papers, Inc.	Appleton	130	130	0	0	0
Consolidated Papers, Inc.	Stevens Point	115	0	0	115	0
Consolidated Papers, Inc.	Wisconsin Rapids	775	0	465	310	0
Green Bay Packaging, Inc.	Green Bay	200	0	0	0	200
Flambeau Paper Co.	Park Falls	110	110	0	0	0
Midtec Paper Corp.	Kimberly	115	0	0	115	0
Pentair Industries	Niagara	170	0	0	170	0
Mosinee Paper Mills Co.	Mosinee	200	0	200	0	0
Nekoosa Papers Inc.	Nekoosa	310	0	310	0	0
Nekoosa Papers Inc.	Port Edwards	215	215	0	0	0
Owens-Illinois	Tomahawk	1,000	0	0	0	1,000
Procter and Gamble Inc.	Green Bay	(2/)	(2/)	(2/)	(2/)	(2/)
Rhinelander Paper Co.	Rhinelander	75	75	0	0	0
Flinkote Company	Cornell	100	0	0	100	0
Superior Fiber Products Co.	Superior	180	0	0	180	0
Thilmany Pulp and Paper Co.	Kaukauna	400	0	400	0	0
Tomahawk Pulp Co., Inc.	Tomahawk	50	0	0	50	0
Wausau Paper Mills Co.	Brokaw	185	185	0	0	0
Superwood	Phillips	100	0	0	100	0
Total.....	23 Plants.....	5,160	1,185	1,375	1,400	1,200
All States	40 Plants	11,160	1,185	3,005	4,205	2,765

1/ Lockwood's Directory of the Paper and Allied Industries--1980.

2/ Capacity not available.

Table 4.--Average annual pulpwood production for selected species groups, based on a 3-year running average, Lake States, 1969-1978

(In thousand standard cords, unpeeled)

Year	Balsam fir	Pine	Spruce	Birch	Other hardwoods[1]
1969	157[2]	662	221	99	454
1970	153	699	227	112	493
1971	167	709	239	124	562
1972	174	682	249	136	656
1973	209	706	262	176	813
1974	249	701	272	186	750
1975	261	734	255	205	742
1976	266	715	239	193	667
1977	254	764	224	215	773
1978	271	807	219	228	823
Average annual change (percent)	+6.3	+2.2	-0.1	+9.7	+6.8

[1] Excludes aspen and birch.

[2] Average of annual production during 1968, 1969, and 1970.

same and no important mill capacity changes or new mill construction was announced.

Softwood plantations (mainly pine) are maturing in the Central States and have provided more pulpwood from thinnings in recent years. Softwoods, accounting for 12 percent of the roundwood cut in 1979, will probably increase their share of the roundwood cut during the next decade.

During the 1975-1979 period, annual productio has stabilized in the 50,000 to 70,000 cord range f soft hardwoods and in the 50,000 to 85,000 cord rang for hard hardwoods. Demand for these species a Central States mills depends greatly on housin starts and home improvements. Ten of the 12 mill produce home-building materials.

Table 5.--Production and imports of pulpwood, Central States, 1979

(In standard cords, unpeeled)[1/]

Species and destination	Prouction by States [2/]				Imports				Total receipts
	Illinois	Indiana	Iowa	Missouri	Regional total	Lake States	Other U.S.	Total imports	
OFTWOODS:									
Illinois	7,072	3,926	0	1,753	12,751	0	0	0	12,751
Ind.,Iowa,Mo. [3/]	0	0	0	0	0	0	4,800	4,800	4,800
Exported [4/]	6,406	0	0	55	6,461	0	0	0	0
Total	13,478	3,926	0	1,808	19,212	0	4,800	4,800	17,551
OFT HARDWOODS:									
Illinois	3,846	1,818	154	3,843	9,661	5,277	96	5,373	15,034
Ind.,Iowa,Mo. [3/]	5,924	10,388	27,663	9,795	53,770	1,978	1,203	3,181	56,951
Exported [4/]	2,141	0	0	3,550	5,691	0	0	0	0
Total	11,911	12,206	27,817	17,188	69,122	7,255	1,299	8,554	71,985
IARD HARDWOODS:									
Illinois	2,883	2,387	0	0	5,270	219	109	328	5,598
Ind.,Iowa,Mo. [3/]	5,427	10,336	11,612	2,439	29,814	2,899	1,197	4,096	33,910
Exported [4/]	19,141	9,104	0	4,741	32,986	0	0	0	0
Total	27,451	21,827	11,612	7,180	68,070	3,118	1,306	4,424	39,508
OTAL ROUNDWOOD:									
Illinois	13,801	8,131	154	5,596	27,682	5,496	205	5,701	33,383
Ind.,Iowa,Mo. [3/]	11,351	20,724	39,275	12,234	83,584	4,877	7,200	12,077	95,661
Exported [4/]	27,688	9,104	0	8,346	45,138	0	0	0	0
Total	52,840	37,959	39,429	26,176	156,404	10,373	7,405	17,778	129,044
ESIDUE, SOFTWOOD:									
Illinois	952	0	1,382	67	2,401	6,299	4,382	10,681	13,082
Ind.,Iowa,Mo. [3/]	0	0	0	0	0	0	4,800	4,800	4,800
Exported [4/]	1,558	143	6,136	1,781	9,618	0	0	0	0
Total	2,510	143	7,518	1,848	12,019	6,299	9,182	15,481	17,882
RESIDUE, HARDWOOD:									
Illinois	11,394	11,739	339	7,963	31,435	13,486	1,224	14,710	46,145
Ind.,Iowa,Mo. [3/]	14,322	48,220	15,093	16,138	93,773	7,881	0	7,881	101,654
Exported [4/]	20,828	106,364	6,435	49,259	182,886	0	0	0	0
Total	46,544	166,323	21,867	73,360	308,094	21,367	1,224	22,591	147,799
ALL WOOD MATERIAL:									
Illinois	26,147	19,870	1,875	13,626	61,518	25,281	5,811	31,092	92,610
Ind.,Iowa,Mo. [3/]	25,673	68,944	54,368	28,372	177,357	12,758	12,000	24,758	202,115
Exported [4/]	50,074	115,611	12,571	59,386	237,642	0	0	0	0
Total	101,894	204,425	68,814	101,384	476,517	38,039	17,811	55,850	294,725

[1/] Factors used in converting to standard green cords (128 cu. ft.) were: 4,500 pounds of soft hardwood roundwood; 5,000 pounds of hard hardwood or coniferous roundwood; 4,100 pounds of softwood chips (green); 4,400 pounds of hardwood chips (green); 2,500 Pounds of chips (all species, dry).

[2/] Vertical columns of figures under box heading--Production by States--present the amount of pulpwood cut in each State.

[3/] Combined to prevent disclosure of individual mill receipts.

[4/] Pulpwood shipped to mills outside the region.

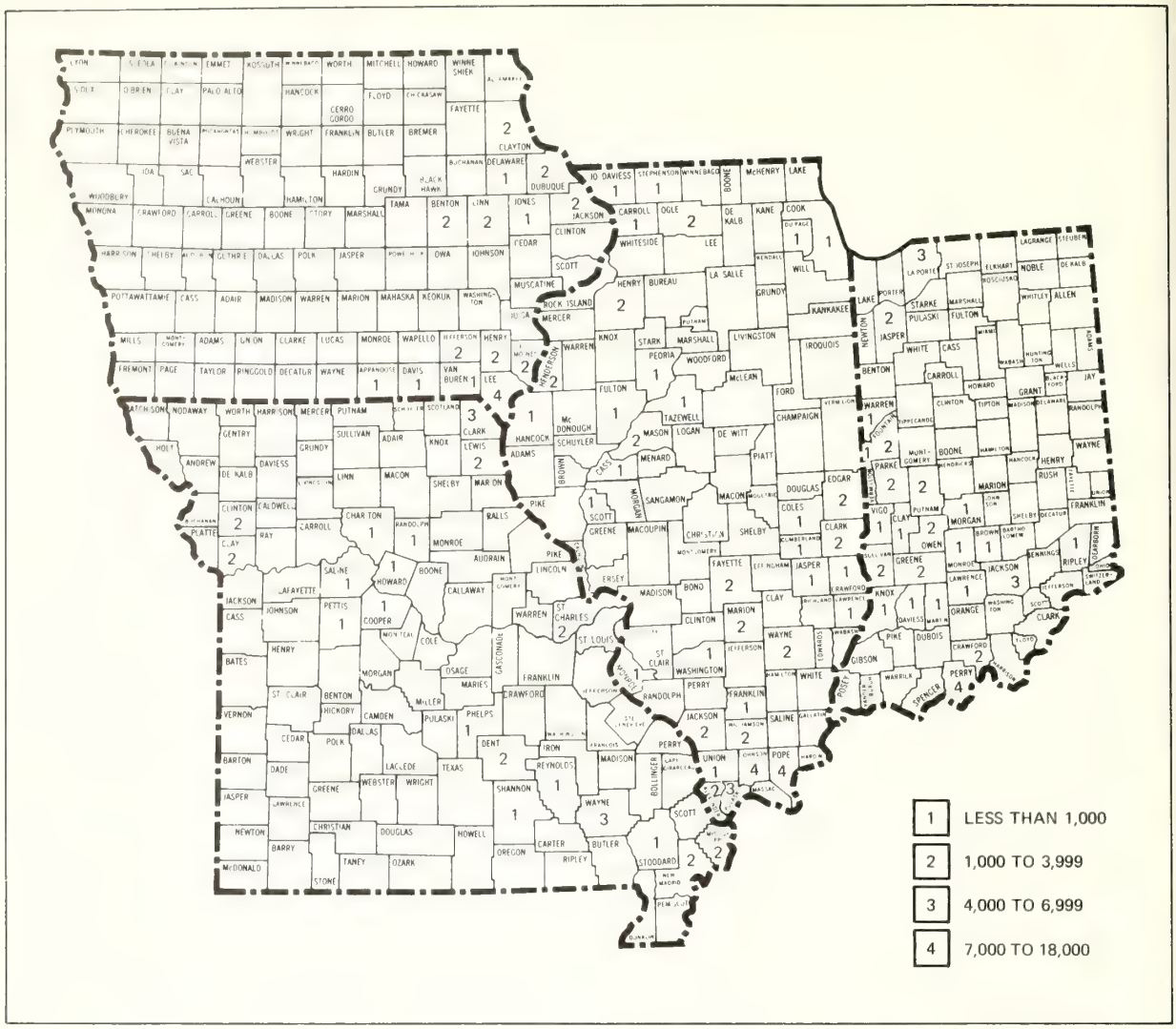


Figure 3.—*Harvest of pulpwood bolts in the Central States by counties, in standard cords, 1979.*

Table 6.--Active woodpulp mills in the Central States, by location, type of pulp produced, and average daily production, 1979

(In tons per 24 hours)[1/]

Company	Location	Average production				
		Total	Sulfite	Kraft	Groundwood and other mechanical	Semi-chemical
ILLINOIS:						
Bird and Son, Inc.	Chicago	40	0	0	40	0
Celotex Corp.	Peoria	90	0	0	90	0
Certain-Teed Products Corp.	East St. Louis	100	0	0	100	0
Flintkote Co., The	Mt. Carmel	40	0	0	40	0
GAF Corp.	Joliet	150	0	0	150	0
Johns-Manville Products Corp.	Waukegan	50	0	0	50	0
Celotex Corp.	Wilmington	30	0	0	30	0
Total.....	7 plants.....	500	0	0	500	0
INDIANA:						
Weston Paper and Mfg. Co.	Terre Haute	270	0	0	0	270
Total.....	1 plant.....	270	0	0	0	270
IOWA:						
Celotex Corp.	Dubuque	90	0	0	90	0
Consolidated Packaging Corp.	Fort Madison	140	0	0	0	140
Total.....	2 plants.....	230	0	0	90	140
MISSOURI:						
GAF Corp.	Kansas City	90	0	0	90	0
Huebert Fibreboard, Inc.	Booneville	60	0	0	60	0
Total.....	2 plants.....	150	0	0	150	0
All States	12 plants	1,150	0	0	740	410

1/ Lockwood's Directory of the Paper and Allied Industries--1980.
2/ Capacity not available.

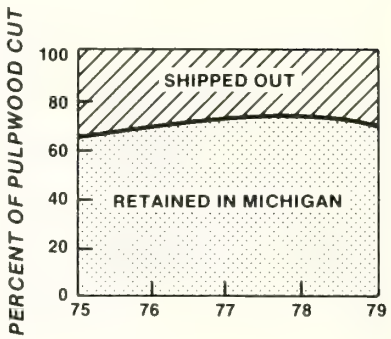
APPENDIX

Table 7.--Lake States pulpwood production[1/] by State of origin and destination, 1975-1979

(In thousand standard cords, unpeeled)

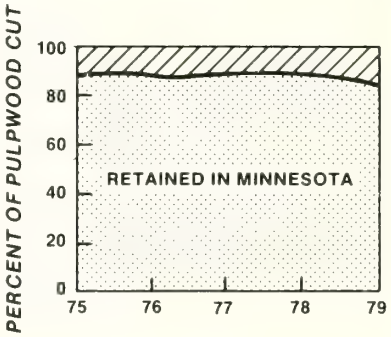
MICHIGAN

	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
1975	1,280	--	449	814	17
1976	1,541	--	434	1,081	26
1977	1,595	--	407	1,159	29
1978	1,675	--	404	1,248	23
1979	1,981	(2/)	516	1,428	37
5-year average	1,614	(2/)	442	1,146	26



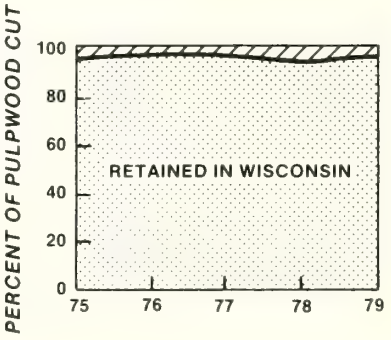
MINNESOTA

	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
1975	1,359	1,173	178	--	8
1976	1,309	1,109	182	--	18
1977	1,333	1,149	154	--	30
1978	1,338	1,155	162	--	21
1979	1,458	1,226	169	--	63
5-year average	1,359	1,162	169	--	28



WISCONSIN

	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
1975	1,505	20	1,460	19	6
1976	1,840	23	1,784	24	9
1977	1,816	26	1,714	64	12
1978	1,895	26	1,779	70	20
1979	2,109	20	2,024	47	18
5-year average	1,833	23	1,752	45	13



1/Production in 1975-1978 does not include wood for particleboard or waferboard plants.

2/Less than 500 cords.

Table 8.--Lake States pulpwood production from roundwood by forest inventory unit and destination by State, 1979

(In hundred standard cords, unpeeled)

Unit	Total cut	Destination of pulpwood			
		Michigan	Minnesota	Wisconsin	Other
MICHIGAN					
E. Upper Peninsula	4,566	2,673	0	1,693	200
W. Upper Peninsula	5,609	2,506	0	3,101	2
N. Lower Peninsula	7,586	7,309	0	252	25
S. Lower Peninsula	272	272	0	0	0
Total roundwood	18,033	12,760	0	5,046	227
Total residue	1,778	1,518	0	115	145
Total	19,811	14,278	0	5,161	372
MINNESOTA					
Aspen-Birch	6,955	0	5,717	681	557
Northern Pine	5,850	0	5,012	826	12
Central Hardwood	568	0	535	32	1
Prairie	28	0	8	20	0
Total roundwood	13,401	0	11,272	1,559	570
Total residue	1,179	0	991	133	55
Total	14,580	0	12,263	1,692	625
WISCONSIN					
Northeastern	7,862	127	10	7,691	34
Northwestern	7,004	42	149	6,813	0
Central	3,273	0	0	3,270	3
Southwestern	253	0	0	202	51
Southeastern	101	0	0	101	0
Total roundwood	18,493	169	159	18,077	88
Total residue	2,592	298	45	2,160	89
Total	21,085	467	204	20,237	177

Table 9.--Lake States pulpwood production[1] from roundwood by species, State, and Forest Inventory Unit, 1975-1979

(In thousand standard cords, unpeeled)

MICHIGAN

Unit	Aspen					Balsam fir					Birch					Hemlock				
	Annual production					Annual production					Annual production					Annual production				
	1975	1976	1977	1978	1979	1975	1976	1977	1978	1979	1975	1976	1977	1978	1979	1975	1976	1977	1978	1979
Eastern Upper Peninsula	68	93	106	103	125	36	41	48	44	43	6	20	22	28	35	16	35	31	24	26
Western Upper Peninsula	138	176	195	220	204	34	31	45	42	41	8	29	29	46	53	34	44	31	24	19
Northern Lower Peninsula	228	216	222	257	375	4	3	2	1	1	22	20	11	16	21	--	(2/)	(2/)	(2/)	--
Southern Lower Peninsula	1	6	9	6	5	--	--	--	--	--	(2/)	(2/)	(2/)	(2/)	(2/)	--	--	--	--	--
Total	435	491	532	586	709	74	75	95	87	85	36	69	62	90	109	50	79	62	48	45

MINNESOTA

Aspen-Birch	357	372	375	363	392	76	44	60	59	72	16	21	15	2	3	--	--	--	--	--
Northern Pine	236	276	292	306	404	45	30	39	37	46	18	23	13	5	1	--	--	--	--	--
Central Hardwood	22	25	30	35	41	--	(2/)	--	--	(2/)	2	2	2	2	3	--	--	--	--	--
Prairie	--	--	--	--	1	--	--	--	--	--	(2/)	--	--	--	--	--	--	--	--	--
Total	615	673	697	704	838	121	74	99	96	118	36	46	30	9	7	--	--	--	--	--

WISCONSIN

Northeastern	286	345	334	331	364	64	61	57	53	60	33	50	54	62	76	30	27	32	30	26
Northwestern	276	308	329	300	319	33	26	15	21	23	44	56	44	53	63	13	9	8	19	13
Central	25	38	31	37	66	1	2	1	1	1	6	8	5	6	11	3	7	3	4	1
Southwestern	--	--	1	1	1	--	--	--	--	--	(2/)	--	(2/)	(2/)	(2/)	--	--	--	--	--
Southeastern	1	2	1	(2/)	1	--	--	--	(2/)	--	(2/)	(2/)	(2/)	(2/)	1	(2/)	--	--	--	--
Total	588	693	696	669	751	98	89	73	75	84	83	114	103	121	151	46	43	43	53	40
Lake States	1,638	1,857	1,925	1,959	2,298	293	238	267	258	287	155	229	195	220	267	96	122	105	101	85

(Table 9 continued on next page)

1/ Production in 1975-1978 does not include wood for particleboard or waferboard plants.
2/ Less than 500 cords.
3/ Includes small quantity of cedar not shown in other parts of table.

(Table 9 continued)

MICHIGAN

Unit	Pine					Spruce					Tamarack					Other hardwoods				
	Annual production					Annual production					Annual production					Annual production				
	1975	1976	1977	1978	1979	1975	1976	1977	1978	1979	1975	1976	1977	1978	1979	1975	1976	1977	1978	1979
Eastern Upper Peninsula	59	88	82	85	119	18	17	27	25	21	1	(2/)	2	1	1	35	82	69	73	83
Western Upper Peninsula	25	43	49	50	48	25	14	21	18	17	1	1	1	1	1	57	88	84	134	174
Northern Lower Peninsula	143	140	119	122	166	2	1	(2/)	(2/)	1	--	--	--	--	--	124	147	162	179	194
Southern Lower Peninsula	8	10	12	20	17	--	--	--	--	--	--	--	--	--	--	2	3	18	3	5
Total	235	281	262	277	350	45	32	48	43	39	2	1	3	2	2	218	320	333	389	456

MINNESOTA

Aspen-Birch	116	104	97	89	75	153	129	110	126	119	31	19	24	18	18	12	19	12	17	18
Northern Pine	79	64	73	89	75	49	46	43	38	34	25	17	15	10	16	7	7	5	9	9
Central Hardwood	4	4	4	8	8	--	(2/)	(2/)	(2/)	(2/)	(2/)	(2/)	(2/)	--	(2/)	3	6	8	13	4
Prairie	--	--	--	--	--	--	--	--	(2/)	--	(2/)	1	3	2	2	--	--	--	--	--
Total	199	172	174	186	158	202	175	153	164	153	56	37	42	30	36	22	32	25	39	31

WISCONSIN

Northeastern	46	55	68	98	95	18	14	16	16	14	2	2	2	2	1	89	158	152	113	150
Northwestern	64	96	103	122	113	7	4	3	3	4	1	1	1	1	1	81	122	104	159	165
Central	122	124	113	121	127	(2/)	1	(2/)	(2/)	(2/)	1	(2/)	1	(2/)	(2/)	71	140	121	91	121
Southwestern	2	5	8	11	20	--	--	--	--	--	--	--	--	--	--	2	3	4	8	4
Southeastern	5	6	4	5	6	--	--	--	--	1	--	--	--	--	--	1	2	2	2	1
Total	239	286	296	357	361	25	19	19	19	19	4	3	4	3	2	244	425	383	373	441
Lake States	673	739	732	820	869	272	226	220	226	211	62	41	49	35	40	484	777	741	801	928

(Table 9 continued on next page)

Table 9.--continued

Unit	All species[3/] Annual production				
	1975	1976	1977	1978	1979
MICHIGAN					
Eastern Upper Peninsula	241	379	390	387	457
Western Upper Peninsula	323	428	458	537	561
Northern Lower Peninsula	523	527	516	575	759
Southern Lower Peninsula	11	19	39	29	27
Total	1,098	1,353	1,403	1,528	1,804
MINNESOTA					
Aspen-Birch	761	708	693	674	696
Northern Pine	459	463	480	494	585
Central Hardwood	31	37	44	58	56
Prairie	2/	1	3	2	3
Total	1,251	1,209	1,220	1,228	1,340
WISCONSIN					
Northeastern	568	712	716	706	786
Northwestern	519	622	608	678	701
Central	229	320	275	260	327
Southwestern	4	8	13	20	25
Southeastern	7	10	7	7	10
Total	1,327	1,672	1,619	1,671	1,849
Lake States	3,676	4,234	4,242	4,427	4,993

Table 10.--Lake States pulpwood production from roundwood by county and species, 1979

(In standard cords, unpeeled)

MICHIGAN

Unit and county[1/]	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tama-rack	Ash	Aspen	Balsam poplar	Bass-wood
E. UPPER PENINSULA:												
Alger	933	5,098	6,919	8,427	1,404	843	1,760	234	66	10,547	2,494	227
Chippewa	419	4,997	1,165	27,279	1,341	847	3,575	184	46	4,717	455	12
Delta	1,192	10,683	4,172	5,879	2,150	986	3,410	346	420	33,321	3,699	176
Luce	204	3,041	5,739	31,153	1,152	748	3,354	72	18	4,086	390	16
Mackinac	470	4,939	1,168	3,663	794	425	4,315	83	289	12,802	590	39
Menominee	531	9,320	4,557	1,793	754	367	3,608	312	1,751	46,202	1,704	177
Schoolcraft	387	4,698	2,613	26,123	1,522	814	1,243	88	94	13,136	3,073	34
Total	4,136	42,776	26,333	104,317	9,117	5,030	21,265	1,319	2,684	124,811	12,405	681
W. UPPER PENINSULA:												
Baraga	780	4,097	2,438	1,119	1,039	494	984	165	385	13,229	427	70
Dickinson	177	3,995	689	831	566	121	3,380	40	673	40,626	1,838	353
Gogebic	690	3,834	5,055	2,371	1,252	549	1,396	157	616	21,461	0	326
Houghton	143	1,711	894	5,012	1,019	214	360	33	80	3,595	0	77
Iron	912	17,595	3,848	7,177	2,697	642	6,548	273	746	58,094	415	172
Keweenaw	0	247	264	0	13	6	70	2	1	0	0	0
Marquette	1,272	9,400	4,837	18,972	2,564	1,244	3,567	367	1,302	31,206	3,180	353
Ontonagon	65	484	548	390	87	42	271	15	2,403	36,592	39	577
Total	4,039	41,363	18,573	35,872	9,237	3,312	16,576	1,052	6,206	204,803	5,899	1,928
N. LOWER PENINSULA:												
Alcona	0	0	0	4,132	537	0	0	0	260	25,954	1,154	22
Alpena	0	0	0	3,870	536	0	0	0	520	14,808	799	67
Antrim	0	0	0	45	0	0	0	0	35	978	0	104
Arenac	0	0	0	0	306	0	0	0	60	2,025	59	1
Bay	0	0	0	28	21	0	0	0	0	125	0	0
Benzie	0	0	0	99	136	0	0	0	402	6,139	0	408
Charlevoix	0	0	0	0	0	0	0	0	0	42	0	0
Cheboygan	0	360	0	6,035	116	0	50	0	160	31,543	133	742
Clare	0	0	0	1,579	0	0	0	0	20	29,272	0	44
Crawford	0	130	0	15,328	245	146	194	0	4	2,691	0	0
Emmet	0	0	0	8	17	0	0	0	0	3,659	0	0
Gladwin	0	0	0	22	17	0	0	0	55	6,540	22	52
Grand Traverse	0	0	0	3,597	62	57	0	0	104	3,712	0	104
Iosco	0	0	0	7,805	810	47	0	0	0	1,178	44	0
Isabella	0	0	0	0	154	0	0	0	3	5,876	0	0
Kalkaska	0	0	0	2,763	1,114	78	0	0	106	8,322	0	104
Lake	0	0	0	14,317	0	0	0	0	635	15,425	0	416
Leelanau	0	0	0	369	0	0	0	0	364	294	0	364
Manistee	0	0	0	0	362	0	0	0	422	9,656	0	77
Mason	0	0	0	0	2,152	0	0	0	269	8,884	0	304
Mecosta	0	0	0	0	3,165	0	0	0	60	10,053	0	0
Midland	0	0	0	33	41	0	0	0	0	3,005	0	0
Missaukee	0	102	0	729	729	0	153	0	54	9,704	0	52
Montmorency	0	23	0	11,514	132	0	0	0	345	30,743	511	44
Newaygo	0	0	0	0	15,665	0	0	0	234	11,405	0	0
Oceana	0	0	0	0	1,163	0	0	0	377	11,413	0	156
Ogemaw	0	0	0	6,036	0	0	0	0	94	14,912	22	52
Osceola	0	0	0	0	3,296	0	0	0	103	11,328	0	52
Oscoda	0	0	0	24,425	2,210	0	0	0	175	26,885	311	74
Otsego	0	0	0	6,045	1,368	89	0	0	22	25,507	0	21
Presque Isle	0	433	0	2,314	256	0	295	0	800	16,957	577	89
Roscommon	0	102	0	2,739	0	0	153	0	23	15,000	0	21
Wexford	0	0	0	8,640	8,384	0	0	0	325	11,133	0	312
Total	0	1,150	0	122,472	42,994	417	845	0	6,031	375,168	3,632	3,682
S. LOWER PENINSULA												
Allegan	0	0	0	756	756	0	0	0	25	963	0	0
Barry	0	0	0	0	290	0	0	0	0	88	0	0
Gratiot	0	0	0	0	0	0	0	0	2	213	0	0
Ionia	0	0	0	0	18	0	0	0	0	0	0	0
Kalamazoo	0	0	0	0	79	0	0	0	0	0	0	0
Kent	0	0	0	0	504	0	0	0	7	139	0	0
Livingston	0	0	0	0	55	0	0	0	0	0	0	0
Montcalm	0	0	0	0	514	0	0	0	15	2,375	0	0
Muskegon	0	0	0	0	3,627	0	0	0	29	299	0	0
Ottawa	0	0	0	0	9,295	0	0	0	21	456	0	0
Saginaw	0	0	0	0	0	0	0	0	0	63	0	0
Shiawassee	0	0	0	0	114	0	0	0	0	0	0	0
Tuscola	0	0	0	0	243	0	0	0	0	0	0	0
Van Buren	0	0	0	0	516	0	0	0	0	22	0	0
Washtenaw	0	0	0	0	460	0	0	0	0	0	0	0
Total	0	0	0	756	16,471	0	0	0	99	4,618	0	0
State total	8,175	85,289	44,906	263,417	77,819	8,759	38,686	2,371	15,020	709,400	21,936	6,291

(Table 10 continued on next page)

(Table 10 continued)

MICHIGAN

Unit and county[1/]	Beech	White birch	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Other hard-woods	All species
E. UPPER PENINSULA:												
Alger	3,851	6,814	1,327	0	595	0	2,713	7,415	143	0	462	62,272
Chippewa	327	1,283	251	0	78	0	680	1,375	24	0	67	49,122
Delta	1,356	7,713	842	0	2,074	0	5,004	8,163	206	0	481	92,273
Luce	992	1,399	339	0	152	0	1,264	1,602	30	0	87	55,838
Mackinac	2,093	2,715	347	0	108	0	1,171	3,454	32	0	92	39,589
Menominee	1,690	5,584	1,054	0	1,200	0	6,000	6,426	461	7	427	93,925
Schoolcraft	854	4,029	823	0	342	0	1,638	1,803	78	0	208	63,600
Total	11,163	29,537	4,983	0	4,549	0	18,470	30,238	974	7	1,824	456,619
W. UPPER PENINSULA:												
Baraga	0	6,479	4,969	0	3,294	0	13,857	10,882	134	0	897	65,739
Dickinson	0	5,337	853	0	1,005	0	3,746	6,166	200	0	407	71,003
Gogebic	0	634	3,122	0	9,010	0	11,473	3,568	153	0	473	66,140
Houghton	0	735	1,550	0	1,523	0	3,226	1,386	5	0	313	21,876
Iron	0	5,354	4,719	0	5,427	0	11,690	7,899	83	0	1,205	135,496
Keweenaw	0	0	15	0	15	0	73	11	0	0	3	720
Marquette	136	10,644	4,393	0	1,724	0	22,593	14,741	1,188	0	823	134,506
Ontonagon	0	747	2,985	0	4,527	0	8,203	6,960	118	0	407	65,460
Total	136	29,930	22,606	0	26,525	0	74,861	51,613	1,881	0	4,528	560,940
N. LOWER PENINSULA:												
Alcona	80	1,144	0	0	0	0	200	2,099	9,723	894	54	46,253
Alpena	140	1,722	0	0	0	0	380	2,597	3,783	432	0	29,654
Antrim	104	10	0	0	0	0	156	156	52	5	47	1,692
Arenac	27	269	23	0	7	0	102	348	1,631	183	6	5,047
Bay	0	42	0	0	0	0	0	0	0	0	0	216
Benzie	439	226	0	0	0	0	416	2,524	570	312	334	12,005
Charlevoix	0	0	0	0	0	0	0	0	0	0	0	42
Cheboygan	640	3,754	0	0	0	0	120	4,181	146	18	0	47,998
Clare	432	904	0	0	0	0	314	4,959	3,287	446	52	41,309
Crawford	58	66	0	0	0	0	12	2,659	3,014	92	52	24,691
Emmet	0	224	0	0	0	0	0	350	60	9	0	4,327
Gladwin	0	381	0	0	0	0	5	959	317	87	32	8,489
Grand Traverse	104	141	0	0	0	0	832	1,040	832	416	82	11,083
Iosco	0	0	0	0	0	0	0	144	0	0	0	10,028
Isabella	2	0	0	0	0	0	6	6	5	2	0	6,054
Kalkaska	104	157	0	0	0	0	56	911	915	82	7	14,719
Lake	405	215	0	0	0	0	643	9,322	16,342	2,062	350	60,132
Leelanau	520	0	0	0	0	0	520	520	416	187	198	3,752
Manistee	416	422	0	0	0	0	429	2,130	7,417	491	416	22,238
Mason	229	526	0	0	0	0	250	4,529	4,268	337	253	22,001
Mecosta	51	3	0	0	0	0	154	370	1,885	322	14	16,077
Midland	0	208	0	0	0	0	0	84	0	0	0	3,371
Missaukee	104	227	0	0	0	0	56	845	506	72	11	13,344
Montmorency	100	2,333	0	0	0	0	275	2,877	4,563	376	24	53,860
Newaygo	106	146	0	0	0	0	366	1,314	7,332	1,518	76	38,162
Oceana	433	199	0	0	0	0	520	2,509	2,965	693	108	20,536
Ogemaw	23	280	0	0	0	0	56	2,268	2,184	223	104	26,254
Osceola	88	266	0	0	0	0	173	1,663	2,261	275	27	19,532
Oscoda	75	2,640	0	0	0	0	157	2,584	7,463	538	58	67,595
Otsego	21	1,923	0	0	0	0	23	3,160	644	6	21	38,850
Presque Isle	240	2,670	0	0	0	0	600	4,558	1,208	165	0	31,162
Roscommon	21	157	0	0	0	0	25	329	1,991	46	22	20,629
Wexford	521	170	0	0	0	0	1,162	4,231	1,543	516	497	37,434
Total	5,483	21,425	23	0	7	0	8,008	66,226	87,323	10,805	2,845	758,536
S. LOWER PENINSULA:												
Allegan	0	0	0	0	0	0	25	50	600	258	0	3,433
Barry	0	0	0	0	0	0	0	0	6	0	0	384
Gratiot	1	0	0	0	0	0	2	4	10	6	1	239
Ionia	0	0	0	0	0	0	0	0	0	0	0	18
Kalamazoo	0	0	0	0	0	0	0	0	0	0	0	79
Kent	3	0	0	0	0	0	7	17	53	21	2	753
Livingston	0	0	0	0	0	0	0	0	0	0	0	55
Montcalm	0	15	0	0	0	0	23	83	620	156	0	3,801
Muskegon	0	29	0	0	0	0	42	194	1,347	291	0	5,858
Ottawa	0	21	0	0	0	0	28	137	950	205	0	11,113
Saginaw	0	0	0	0	0	0	0	0	0	0	0	63
Shiawassee	0	0	0	0	0	0	0	0	0	0	0	114
Tuscola	0	0	0	0	0	0	0	0	0	0	0	243
Van Buren	0	0	0	0	0	0	5	10	65	15	0	633
Washtenaw	0	0	0	0	0	0	0	0	0	0	0	460
Total	4	65	0	0	0	0	132	495	3,651	952	3	27,246
State total	16,786	80,957	27,612	0	31,081	0	101,471	148,572	93,829	11,764	9,200	1,803,341

(Table 10 continued on next page)

(Table 10 continued)

MINNESOTA

Unit and county[1/]	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tamarack	Ash	Aspen	Balsam poplar	Basswood
ASPEN-BIRCH:												
Carlton	0	1,278	0	2,082	229	520	1,919	644	0	9,398	520	0
Cook	0	7,760	0	4,739	23	0	11,171	0	0	29,609	679	0
Koochiching	0	33,031	0	11,403	1,334	1,124	58,893	15,370	0	133,256	8,157	0
Lake	0	2,446	0	12,433	825	0	17,169	155	0	22,264	520	0
St.Louis	0	26,819	0	30,954	6,571	2,346	29,402	2,116	182	197,206	8,022	0
Total	0	71,334	0	61,611	8,982	3,990	118,554	18,285	182	391,733	17,898	0
NORTHERN PINE:												
Aitkin	0	830	0	1,144	0	0	975	907	109	49,331	104	0
Becker	0	0	0	1,040	0	0	0	0	0	2,233	0	0
Beltrami	0	11,342	0	10,865	2,049	53	7,929	6,280	68	54,650	2,169	49
Cass	0	1,175	0	11,451	1,691	309	405	912	45	51,638	1,040	0
Clearwater	0	1,554	0	3,170	0	0	2,229	1,975	0	20,947	0	0
Crow Wing	0	17	0	5,478	0	0	73	0	0	8,076	0	0
Hubbard	0	2,176	0	11,822	622	0	627	371	0	33,053	0	0
Itasca	0	26,229	0	4,519	87	561	8,362	3,033	128	158,094	3,089	0
Lake of the Woods	0	2,562	0	8,169	64	0	10,364	1,336	0	15,207	889	0
Mahnomen	0	0	0	1,040	0	0	0	179	0	2,080	0	0
Roseau	0	208	0	5,224	0	0	3,054	259	0	7,084	0	0
Wadena	0	0	0	6,004	101	0	175	0	0	1,454	0	0
Total	0	46,093	0	69,926	4,614	923	34,193	15,252	350	403,847	7,291	49
CENTRAL HARDWOOD:												
Chisago	0	0	0	16	238	0	0	0	0	312	0	0
Hennepin	0	0	0	0	0	0	0	0	0	0	0	0
Isanti	0	0	0	520	1,144	0	0	0	0	520	0	0
Kanabec	0	0	0	520	104	0	0	0	56	5,045	0	51
Mille Lacs	0	0	0	0	0	0	0	0	447	18,921	0	410
Morrison	0	8	0	1,040	0	0	8	0	56	4,088	0	51
Otter Tail	0	0	0	1,040	0	0	0	228	0	1,040	0	0
Pine	0	0	0	1,059	235	0	34	0	0	11,151	0	0
Ramsey	0	0	0	0	0	0	0	0	0	0	0	0
Sherburne	0	0	0	1,527	88	0	0	0	0	0	0	0
Todd	0	0	0	810	108	0	0	0	0	106	0	0
Total	0	8	0	6,532	1,917	0	42	228	559	41,183	0	512
PRAIRIE:												
Polk	0	0	0	0	0	0	0	2,010	0	832	0	0
Total	0	0	0	0	0	0	0	2,010	0	832	0	0
State total	0	117,435	0	138,069	15,513	4,913	152,789	35,775	1,091	837,595	25,189	561

Unit and county[1/]	Beech	White birch	Yellow birch	Cottonwood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Other hardwoods	All species
ASPEN-BIRCH:												
Carlton	0	24	0	0	0	0	24	0	0	0	0	16,638
Cook	0	262	0	0	0	0	0	0	0	0	0	54,243
Koochiching	0	269	0	0	0	0	125	145	0	0	0	263,107
Lake	0	987	0	0	0	0	0	48	0	0	0	56,847
St.louis	0	902	4	0	14	0	92	45	4	2	0	304,681
Total	0	2,444	4	0	14	0	241	238	4	2	0	695,516
NORTHERN PINE:												
Aitkin	0	102	2	0	19	0	62	32	49	21	0	53,687
Becker	0	0	0	0	0	0	0	0	0	0	0	3,273
Beltrami	0	278	0	0	47	0	274	107	137	274	0	96,571
Cass	0	246	0	0	17	0	14	25	93	37	0	69,098
Clearwater	0	0	0	0	0	0	0	0	0	0	0	29,875
Crow Wing	0	0	0	0	0	0	0	0	0	0	0	13,644
Hubbard	0	0	0	0	0	0	0	0	0	0	0	48,671
Itasca	0	380	2	0	22	0	82	84	32	14	0	204,718
Lake of the Woods	0	0	0	0	0	0	0	0	0	0	0	38,591
Mahnomen	0	0	0	0	0	0	0	0	0	0	0	3,299
Roseau	0	0	0	0	0	0	0	0	0	0	0	15,829
Wadena	0	0	0	0	0	0	0	0	0	0	0	7734
Total	0	1,006	4	0	105	0	432	248	311	346	0	584,990
CENTRAL HARDWOOD:												
Chisago	0	0	0	0	0	0	0	0	0	0	0	566
Hennepin	0	0	0	0	600	0	0	0	0	0	0	600
Isanti	0	0	0	0	0	0	0	0	0	0	0	2,184
Kanabec	0	192	0	0	48	0	0	48	96	0	0	6,160
Mille Lacs	0	1,542	0	0	386	0	0	386	771	0	0	22,863
Morrison	0	192	0	0	48	0	0	48	96	0	0	5,635
Otter Tail	0	0	0	0	0	0	0	0	0	0	0	2,308
Pine	0	1,281	0	0	0	0	0	0	0	0	0	13,760
Ramsey	0	0	0	0	103	0	0	0	0	0	0	103
Sherburne	0	0	0	0	0	0	0	0	0	0	0	1,615
Todd	0	0	0	0	0	0	0	0	0	0	0	1,024
Total	0	3,207	0	0	1,185	0	0	482	963	0	0	56,818
PRAIRIE:												
Polk	0	0	0	0	0	0	0	0	0	0	0	2,842
Total	0	0	0	0	0	0	0	0	0	0	0	2,842
State total	0	6,657	8	0	1,304	0	673	968	1,278	348	0	1,340,166

(Table 10 continued on next page)

(Table 10 continued)

WISCONSIN

Unit and county 1/	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tamarack	Ash	Aspen	Balsam poplar	Basswood
NORTHEASTERN:												
Florence	1	1,368	212	974	3,489	216	655	30	923	38,420	3	0
Forest	50	18,699	3,845	1,218	4,847	268	4,234	129	2,608	40,896	6	570
Langlade	0	2,484	320	513	3,074	46	327	46	2,162	24,198	10	1,785
Lincoln	41	4,127	1,252	932	2,148	252	801	160	1,916	32,729	0	2,650
Marinette	32	3,125	1,792	16,884	10,898	578	1,398	49	1,649	79,384	94	1
Oconto	0	3,604	264	3,864	10,875	617	429	22	119	15,113	4	0
Oneida	74	19,949	4,516	10,383	7,820	1,869	5,066	231	2,629	62,535	0	1,941
Shawano 2/	0	168	12,636	2,386	3,503	127	0	0	512	25,798	0	7
Vilas	5	6,923	963	2,938	2,440	1,330	1,318	42	258	45,252	0	851
Total	203	60,447	25,800	40,092	49,049	5,303	14,228	709	12,776	364,325	117	7,805
NORTHWESTERN:												
Ashland	28	7,696	436	4,375	1,511	341	944	29	1,349	35,943	0	203
Barron	0	0	0	235	29	0	0	0	1,121	632	0	176
Bayfield	7	1,959	89	15,994	2,952	515	218	0	404	50,280	0	0
Burnett	0	26	0	9,189	8,016	505	0	0	7	3,778	0	0
Douglas	0	479	0	39,765	2,795	193	74	0	73	38,444	0	59
Iron	8	1,498	387	922	424	297	239	32	847	26,385	0	869
Polk	0	0	0	221	11	22	0	0	0	285	0	0
Price	107	5,950	2,457	1,066	1,581	255	1,610	560	4,589	50,641	0	2,734
Rusk	0	133	249	134	156	0	0	10	1,832	16,560	0	653
Sawyer	14	2,464	7,468	6,185	3,612	432	220	43	3,432	41,886	0	985
Taylor	0	2,271	1,521	383	793	51	515	25	1,824	27,137	0	635
Washburn	0	66	0	9,622	543	167	298	0	142	26,269	0	0
Total	164	22,542	12,607	88,091	22,423	2,778	4,118	699	15,620	318,240	0	6,314
CENTRAL:												
Adams	0	0	0	13,404	9,948	966	23	0	114	360	0	0
Chippewa	0	38	143	475	1,328	50	0	42	847	9,304	0	559
Clark	0	30	401	1,293	1,938	1,191	0	0	699	11,821	0	15
Eau Claire	0	0	0	3,466	1,809	71	0	0	414	1,015	0	40
Jackson	0	0	0	10,148	2,188	336	0	22	91	1,309	0	0
Juneau	0	0	0	13,749	5,017	580	0	0	44	1,998	0	0
Marathon	0	1,210	686	1,232	3,619	218	31	0	1,038	20,011	0	55
Marquette	0	0	0	2,168	4,175	370	123	0	4	172	0	0
Monroe	0	0	0	3,283	2,888	164	0	0	32	239	0	0
Portage	0	2	78	4,348	3,920	1,790	0	34	62	3,607	0	0
Waupaca	0	15	4	1,039	3,027	864	0	0	88	6,720	0	0
Waushara	0	0	0	2,600	6,966	1,521	0	0	28	94	0	0
Wood	0	0	9	7,974	5,235	1,714	30	0	167	8,889	0	0
Total	0	1,295	1,321	65,179	52,058	9,835	207	98	3,628	65,539	0	669
SOUTHWESTERN:												
Buffalo	0	0	0	389	1,009	138	0	0	0	0	0	0
Crawford	0	0	0	0	0	0	0	0	0	407	0	158
Dunn	0	0	0	1,362	7,492	440	0	0	2	0	0	0
Grant	0	0	0	0	0	0	0	0	0	800	0	330
Iowa	0	0	0	0	0	0	0	0	0	64	0	26
Lacrosse	0	0	0	252	1,169	154	0	0	2	0	0	0
Lafayette	0	0	0	0	0	0	0	0	0	65	0	27
Pepin	0	0	0	517	985	88	0	0	0	0	0	0
Pierce	0	0	0	0	0	0	0	0	0	15	0	0
Richland	0	0	0	0	20	0	0	0	0	0	0	0
Sauk	0	0	0	489	1,774	492	0	0	7	0	0	0
Trempealeau	0	0	0	582	2,018	456	0	0	1	14	0	0
Vernon	0	0	0	0	74	0	0	0	0	22	0	0
Total	0	0	0	3,591	14,541	1,768	0	0	12	1,387	0	541
SOUTHEASTERN:												
Brown	0	0	0	0	422	0	571	0	0	363	0	0
Columbia	0	0	0	768	3,475	35	0	0	52	75	0	0
Dodge	0	0	0	0	0	0	0	0	0	0	0	0
Door	0	0	0	0	36	0	0	0	0	0	0	0
Green	0	0	0	0	148	29	0	0	0	0	0	0
Green Lake	0	0	0	0	50	5	9	0	14	0	0	0
Outagamie	0	0	0	0	104	0	0	0	8	790	0	0
Waukesha	0	0	0	274	969	62	0	0	0	0	0	0
Total	0	0	0	1,042	5,204	131	580	0	74	1,228	0	0
State total	367	84,284	39,728	197,995	143,320	19,815	19,133	1,506	32,110	750,719	117	15,329

(Table 10 continued on next page)

(Table 10 continued) WISCONSIN

Unit and county[1]	Beech	White birch	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Other hard-woods	All species
NORTHEASTERN:												
Florence	0	2,636	906	0	3,127	0	3,410	1,968	348	0	38	58,724
Forest	14	7,905	1,990	0	5,435	0	8,147	4,788	261	208	1,889	108,007
Langlade	0	4,356	2,344	0	5,726	40	13,496	4,887	766	0	834	67,414
Lincoln	0	3,306	576	0	2,992	0	3,597	4,003	1,227	0	124	62,833
Marinette	72	10,033	902	0	2,516	0	2,601	3,480	1,000	241	260	136,989
Oconto	6	1,524	95	0	341	0	465	565	14	0	5	37,926
Oneida	0	19,120	2,243	0	2,673	0	7,078	7,315	5,030	312	376	161,160
Shawano [2]	0	868	382	0	5,392	315	3,950	1,846	675	1	219	58,785
Vilas	0	15,392	1,568	0	2,765	0	6,763	2,436	2,339	247	498	94,328
Total	92	65,140	11,006	0	30,967	355	49,507	31,288	11,660	1,009	4,243	786,166
NORTHWESTERN:												
Ashland	0	9,233	1,541	0	3,492	0	5,716	2,871	784	99	82	76,673
Barron	0	1,624	476	0	216	0	2,168	1,290	1,935	410	72	10,384
Bayfield	0	11,046	96	0	571	0	708	393	626	11	3	85,872
Burnett	0	256	6	0	27	0	40	140	0	0	0	21,990
Douglas	0	1,946	7	0	17	0	28	22	0	0	1	83,903
Iron	0	2,431	535	0	8,162	0	5,496	3,317	298	28	26	52,201
Polk	0	0	0	0	0	0	0	0	0	0	0	539
Price	0	10,326	2,717	0	21,182	0	11,712	7,960	1,952	432	109	127,940
Rusk	0	3,043	714	0	1,880	0	2,902	1,800	939	174	80	31,259
Sawyer	0	10,270	2,103	0	5,918	0	9,693	6,430	2,359	430	442	104,386
Taylor	0	3,294	1,317	0	14,135	0	6,878	4,753	999	565	23	67,119
Washburn	0	471	11	0	145	0	168	157	85	59	3	38,206
Total	0	53,940	9,523	0	55,745	0	45,509	29,133	9,977	2,208	841	700,472
CENTRAL:												
Adams	0	264	8	0	345	0	250	196	5,210	2,935	0	34,023
Chippewa	0	1,316	667	0	1,228	0	1,278	1,216	1,321	743	17	20,572
Clark	0	1,538	303	0	1,826	0	1,541	1,005	4,857	2,274	21	30,753
Eau Claire	0	620	137	0	434	0	523	1,192	4,156	1,097	72	15,046
Jackson	0	404	37	0	372	0	149	258	1,562	650	20	17,546
Juneau	0	758	30	0	777	0	136	506	2,968	2,341	2	28,906
Marathon	0	1,851	1,014	0	25,094	7	10,498	13,143	2,556	2,484	9	84,756
Marquette	0	420	1	0	426	0	212	223	2,235	1,763	1	12,293
Monroe	0	224	19	0	163	0	91	124	842	384	1	8,454
Portage	0	423	5	0	57	0	243	377	1,217	1,359	1	17,523
Waupaca	0	130	49	0	557	76	299	136	406	208	51	13,669
Waushara	0	28	8	0	43	0	26	62	1,021	274	5	12,676
Wood	0	528	133	0	902	0	454	539	2,668	1,850	6	31,098
Total	0	8,504	2,411	0	32,224	83	15,700	18,977	31,019	18,362	206	327,315
SOUTHWESTERN:												
Buffalo	0	0	0	0	0	0	0	0	0	0	0	1,536
Crawford	0	65	0	31	4	0	2	195	333	126	0	1,321
Dunn	0	1	1	0	20	0	9	9	4	2	0	9,342
Grant	0	132	0	54	0	0	0	362	1,002	376	0	3,056
Iowa	0	10	0	4	0	0	0	33	167	63	0	367
Lacrosse	0	1	0	0	6	0	3	5	0	0	1	1,593
Lafayette	0	10	0	4	0	0	0	31	168	62	0	367
Pepin	0	0	0	0	0	0	0	0	0	0	0	1,590
Pierce	0	0	0	0	4	0	2	2	0	0	0	23
Richland	0	0	0	0	0	0	0	0	0	0	0	20
Sauk	0	39	6	0	22	0	36	40	37	14	0	2,956
Trempealeau	0	0	0	0	7	0	3	3	0	0	0	3,084
Vernon	0	0	0	0	0	0	0	0	0	0	0	96
Total	0	258	7	93	63	0	55	680	1,711	643	1	25,351
SOUTHEASTERN:												
Brown	0	0	0	0	0	0	0	0	0	0	0	1,356
Columbia	1	184	4	0	124	0	131	134	406	374	3	5,766
Dodge	0	301	0	0	0	0	0	0	0	0	0	301
Door	0	0	0	0	0	0	0	0	0	0	0	36
Green	0	0	0	0	0	0	0	0	0	0	0	177
Green Lake	4	3	1	0	25	0	14	8	0	0	8	141
Outagamie	0	37	7	0	22	0	34	38	0	0	0	1,040
Waukesha	0	0	0	0	0	0	0	0	0	0	0	1,305
Total	5	525	12	0	171	0	179	180	406	374	11	10,122
State total	97	128,367	22,959	93	119,170	438	110,950	80,258	54,773	22,596	5,302	1,849,426

[1] Includes only those counties that supplied pulpwood in 1979.

[2] Includes Menominee County.

Table 11. Central States pulpwood production by State and destination, 1975-1979

(In thousand standard cords, unpeeled)

Year	Illinois			Indiana			Iowa			Missouri		
	Total	Destination		Total	Destination		Total	Destination		Total	Destination	
		Central States	Other States		Central States	Other States		Central States	Other States		Central States	Other States
1975	105	60	45	135	58	77	50	48	2	116	43	73
1976	116	65	51	172	78	94	45	41	4	132	55	77
1977	111	53	58	161	66	95	50	46	4	123	44	79
1978	100	49	51	190	81	109	42	40	2	99	42	57
1979	102	52	50	204	89	115	69	56	13	101	42	59

Table 12.--Trends in receipts of roundwood and residue as pulpwood, Central States, 1975-1979

(In thousand standard cords, unpeeled)

Type of material and area	1975	1976	1977	1978	1979
ROUNDWOOD:					
Illinois	13	18	24	30	33
Indiana, Iowa, Missouri	74	81	62	70	96
Total	86	99	86	100	129
RESIDUE:					
Illinois	64	71	62	54	59
Indiana, Iowa, Missouri	86	102	98	95	107
Total	150	173	160	149	166
All Material	236	272	246	249	295

Blyth, James E., and W. Brad Smith.
1980. Pulpwood production in the north central region, by county, 1979. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-56, 22 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

Discusses 1979 production and receipts and recent production for other years in the Lake and Central States. Shows Michigan, Minnesota, and Wisconsin production by species for each county and compares production by Forest Inventory Unit with that of previous years. Presents 1979 production and receipts data for Illinois, Indiana, Iowa, and Missouri, and shows four production classes by county.

KEY WORDS: roundwood, residue, receipts, Lake States, Central States.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1981—767-286/13

United States Department of Agriculture

Forest Service

North Central Forest Experiment Station

Resource Bulletin **NC-57**

The Fourth Minnesota Forest Inventory: Timber Volumes and Projections of Timber Supply

John S. Spencer, Jr.

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This report includes the most commonly used Resources Evaluation statistics, but other forest resource data can also be provided. Persons requesting additional information from the raw inventory data are expected to pay the retrieval costs. These costs will vary depending on the complexity of the request, from less than $100.00 for a simple request to $2,000.00 for a complex retrieval involving the services of a Resources Evaluation computer programmer. Requests for data will be scheduled to minimize the impact on the Resources Evaluation work unit.

Requests for unpublished information may be directed to:

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Renewable Resources Evaluation Project
North Central Forest Experiment Station
1992 Folwell Avenue
St. Paul, Minnesota 55108

Phone: (612) 642-5282

Area served: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, eastern South Dakota, Wisconsin.

North Central Forest Experiment Station
Forest Service—U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108
Manuscript approved for publication March 27, 1981
1982

FOREWORD

Resources Evaluation (formerly Forest Survey) is a continuing endeavor mandated by the Forest and Rangeland Renewable Resources Planning Act of 1974, which was preceded by the McSweeney-McNary Forest Research Act of 1928. Its objective is to periodically inventory the Nation's forest land to determine the extent, condition, and volume of timber, growth, and depletions. This kind of up-to-date information is essential for intelligent forest policies and programs. USDA Forest Service regional experiment stations are responsible for conducting these inventories and publishing summary reports for individual States. The North Central Forest Experiment Station is responsible for Resources Evaluation work done in Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, eastern South Dakota, and Wisconsin.

Fieldwork for the 1977 Minnesota Forest Survey was begun in July 1974 and was completed in July 1978. Reports on the three previous surveys of Minnesota's timber resource are dated 1936, 1953, and 1962.

The 1977 Minnesota survey data have been adjusted to take into account the expansion of the reserved portion of the Boundary Waters Canoe Area (BWCA) in the fall of 1978. The adjustments were made so that the data are as current as possible.

The North Central Station has published similar Resource Bulletins reporting statistical highlights and detailed tables on the timber resource of the four Minnesota Survey Units.

More accurate survey information was obtained during the 1977 survey than otherwise would have been feasible because of intensified field sampling. This was made possible by additional funding and manpower provided the North Central Station by the Minnesota Legislature through the State's Department of Natural Resources. The DNR also assisted in a canvass of the State's primary wood-using plants to help estimate the quantity of timber products harvested in Minnesota.

Aerial photos used in the Minnesota Forest Inventory were furnished by Boise Cascade Company, Chippewa National Forest, Lake County Land Commissioner's Office, Minnesota Department of Natural Resources, Superior National Forest, USDA Agricultural Stabilization and Conservation Service, and USDI Bureau of Indian Affairs.

The fourth Minnesota inventory was a team effort. Burton L. Essex, Resources Evaluation Project Leader, directed the inventory and, along with Jerold T. Hahn, designed it and planned the sample selection. Arnold J. Ostrom supervised the aerial photo interpretation work and the field data collection. Photo interpretation was performed by Alexander Vasilevsky, Ronald L. Hackett, and Alan Hendricks. James E. Blyth designed and supervised collection of timber products output and timber removals data and made 30-year projections of removals. Gerhard K. Raile, W. Brad Smith, and Mark H. Hansen, with support from Patsy E. Latourelle, Patrick J. Peine, Joan Stelman, Jean A. Smoley, and Carol Weist, processed the data and generated summary tables. Pamela J. Jakes and John S. Spencer, Jr., checked the consistency of the fourth Minnesota inventory with the third. Spencer made the 30-year projections of the timber resource except for removals. Smith and Jakes evaluated treatment opportunities and estimated predicted yields from selected cutting prescriptions in the State. Peine prepared final tables and Mary Jean Hanson typed the manuscripts.

HIGHLIGHTS

Volume

- Volume of growing stock on commercial forest land increased from 9.4 to 11.5 billion cubic feet between 1962 and 1977, a 21-percent gain.
- Softwood growing-stock volume crept up 3 percent between surveys, but hardwood volume jumped 32 percent.
- Sawtimber volume rose from 14.9 to 24.6 billion board feet between surveys, a gain of 65 percent.
- Average growing-stock volume per acre increased from 613 to 836 cubic feet (7.8 to 10.6 cords) between surveys.
- Total volume in 1977 (13.0 billion cubic feet) included 1.2 billion cubic feet of rough and rotten trees, 0.2 billion of short-log trees, and 0.1 billion in salvable dead trees, in addition to the 11.5 billion in growing-stock trees.
- The Northern Pine Unit contained the largest volume of growing stock (5.0 billion cubic feet), followed by the Aspen-Birch Unit (4.5 billion).
- Nonindustrial private parties owned 39 percent of the growing-stock volume.
- Aspen accounted for 3.4 billion cubic feet — 30 percent of the growing-stock volume.
- Four-fifths of the growing-stock volume is in trees 12 inches or less in diameter.
- Seventy percent of the growing-stock volume is in stands aged 31 to 70 years.
- Three-fourths of the sawtimber volume is in grade 3 logs.

Stand Conditions

- Net annual growth of growing stock declined from 364 to 349 million cubic feet from 1962 to 1976, a 4-percent drop. Softwood growth increased by 12 percent, but hardwood growth fell by 11 percent between surveys.
- The growth rate was 3.0 percent of inventory in 1976. The softwood growth rate (3.4 percent) was somewhat higher than the hardwood rate (2.9 percent).
- The average net annual growth per acre remained nearly constant between surveys — 24 cubic feet in 1962 and 25 cubic feet in 1976.
- Mortality of growing-stock trees amounted to 142 million cubic feet in 1976, 1.2 percent of inventory.
- Disease caused 57 percent of the 1976 mortality.

Timber Use

- Timber removals from growing stock increased from 146 to 194 million cubic feet between 1962 and 1976, a gain of one-third. The increase is due entirely to hardwoods.
- Aspen removals increased from 46 to 73 million cubic feet between surveys.
- Roundwood products accounted for 70 percent of total removals, other removals for 28 percent, and logging residues for 2 percent.
- Pulpwood made up two-thirds of the volume removed for roundwood products.
- Private lands yielded 62 percent of the removals volume, but contained only 45 percent of the inventory.
- A comparison of 1976 removals with predicted yields from selected cutting prescriptions suggested that removals could be substantially higher.

Projections

- The low removals option projection shows inventory increasing from 11.5 to 15.3 billion cubic feet between 1977 and 2007, a 33-percent gain. Growth is projected to approach removals, but to remain higher than removals throughout the period.
- The high removals option shows inventory rising from 11.5 to 14.2 billion cubic feet between 1977 and 1997, then declining to 14.0 billion in 2007. Removals are projected to surpass growth around 2000.

THE FOURTH MINNESOTA FOREST INVENTORY: TIMBER VOLUMES AND PROJECTIONS OF TIMBER SUPPLY

John S. Spencer, Jr.
Principal Resource Analyst

TIMBER VOLUME INCREASED BETWEEN SURVEYS

The volume of growing stock on commercial forest land in Minnesota increased 21 percent between the previous inventory in 1962 (9.4 billion cubic feet) and the latest inventory in 1977 (11.5 billion). This increase occurred as the commercial forest land base declined 11 percent, from 15.4[1] to 13.7 million acres. The continuing recovery and maturation of the forest from the burned and denuded conditions prevalent in the early 1900's is the reason for the accumulating timber volumes.

Softwood growing-stock volume increased 3 percent between surveys, but hardwood volume jumped 32 percent:

Species group	Growing-stock volume 1962	1977
	(Million cubic feet)	
Softwoods	3,384	3,477
Hardwoods	6,060	7,977
Total	9,444	11,454

The volume of sawtimber on commercial forest land increased 65 percent between surveys—from 14.9 to 24.6 billion board feet[2]. Softwood volume increased 39 percent, but hardwood volume jumped 84 percent:

Species group	Sawtimber volume 1962	1977
	(Million board feet)	
Softwoods	6,133	8,530
Hardwoods	8,742	16,077
Total	14,875	24,607

Average volume per acre of growing stock increased from 613 to 836 cubic feet (7.8 to 10.6 cords) between surveys. Average sawtimber volume per acre increased from 965 to 1,797 board feet. The highest average growing-stock volume per acre is in the Northern Pine Unit—872 cubic feet.

In addition to the 11.5 billion cubic feet of growing stock in 1977, Minnesota has 1.2 billion of rough and rotten trees, 0.2 billion of short-log cull trees, and 0.1 billion of salvable dead trees (table 1). The total volume of timber in all classes is 13.0 billion cubic feet.

Table 1.—*Net volume of timber on commercial forest land by class of timber and softwoods and hardwoods, Minnesota, 1977*
(In million cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Growing stock			
Sawtimber	4,732	1,719	3,013
Poletimber	6,722	1,758	4,964
Total growing stock	11,454	3,477	7,977
Rough and rotten cull	1,207	179	1,028
Short-log cull	185	27	158
Salvable dead	107	48	59
All classes	12,953	3,731	9,222

[1] *Published 1962 area and volume statistics have been adjusted to conform to 1977 statistics because of changes in procedures and definitions. (See Comparing Minnesota's Fourth Forest Survey with the Third Survey in Appendix.)*

[2] *International 1/4-inch rule.*

The Northern Pine Unit contains the largest volume of growing stock (5.0 billion cubic feet), followed by the Aspen-Birch Unit (4.5 billion), the Central Hardwoods Unit (1.5 billion), and the Prairie Unit (0.4 billion) (fig. 1). Ninety-eight percent of the softwood volume is in the Northern Pine and Aspen-Birch Units.

St. Louis County accounts for nearly one-fifth of the State's growing-stock volume (2.2 billion cubic feet). Itasca County contains the next largest volume (1.3 billion), followed by Koochiching (0.9 billion), Cass (0.9 billion), Lake (0.7 billion), and Beltrami Counties (0.7 billion) (fig. 2).

NONINDUSTRIAL PRIVATE OWNERS ACCOUNT FOR 39 PERCENT OF VOLUME

Farmers own 24 percent of the State's growing-stock volume, and other private nonindustrial parties own another 15 percent. Together, these two owner groups control the largest timber volume and area of commercial forest in Minnesota. Therefore, the nonindustrial private owner must play a significant role in future plans to improve and utilize the State's timber resource.

County and municipal agencies own 18 percent of the volume, followed by State (17 percent), National Forests (16 percent), forest industry (6 percent), and other federal agencies (4 percent) (fig. 3).

Nonindustrial private parties own 46 percent of the hardwood volume but only 22 percent of the softwood volume. The largest proportions of softwood volume are found on National Forest land (25 percent) and State land (24 percent) (table 2).

Aspen is the dominant species in the State in terms of growing-stock volume, with 3.4 billion cubic feet — 30 percent of the total. Its volume increased by 22 percent between surveys, although the area of aspen forest type declined by 97,500 acres. Much of the area loss resulted from creation of the Voyageurs National Park and expansion of the reserved portion of the Boundary Waters Canoe Area. Aspen was considered a low value weed species for years after it became widely established following intensive cutting of softwoods and subsequent slash burning and wildfires. But now it is regarded as a highly valuable resource by the paper and waferboard industries and as vital food and cover for ruffed grouse, deer, and other wildlife species.

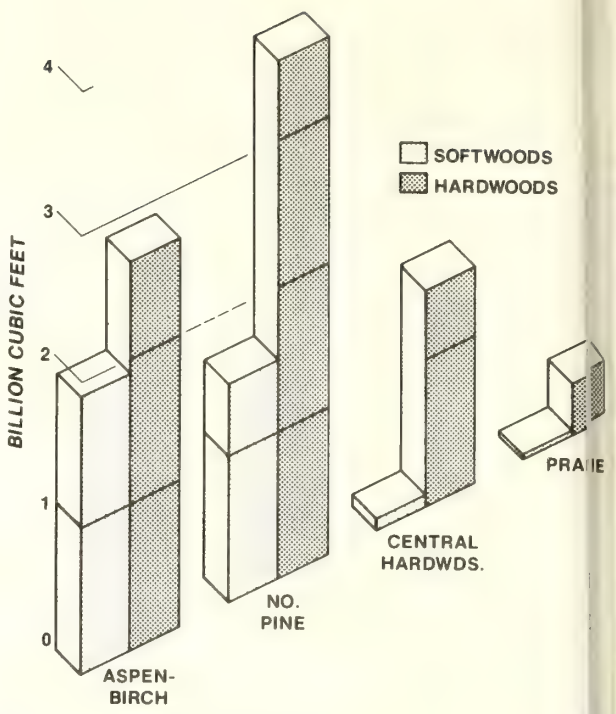


Figure 1.—*Net volume of growing stock on commercial forest land by softwoods and hardwoods and Forest Survey Unit, Minnesota, 1977.*

Paper birch, the species with the next largest volume, accounts for 1.3 billion cubic feet or 11 percent of the total. Aspen, paper birch, balsam fir (0.9 billion cubic feet), spruce (0.7 billion), and jack pine (1.6 billion) account for three-fifths of the State's growing-stock volume. Between surveys, paper birch and balsam fir volumes increased by 51 and 17 percent, respectively, but spruce and jack pine volumes declined 12 and 19 percent, respectively. Spruce and jack pine declined largely because of the transfer of commercial forest to productive-reserved status as the Voyageurs National Park was created and as the reserved portion of the Boundary Waters Canoe Area was enlarged.

EIGHTY PERCENT OF VOLUME IN TREES LESS THAN 12 INCHES IN DIAMETER

Four-fifths of the growing-stock volume is in trees 12 inches or less in diameter (fig. 4). The fact that 35 percent of the aspen volume is in those diameter classes contributes to this volume concentration. A much larger proportion of softwood volume is in the

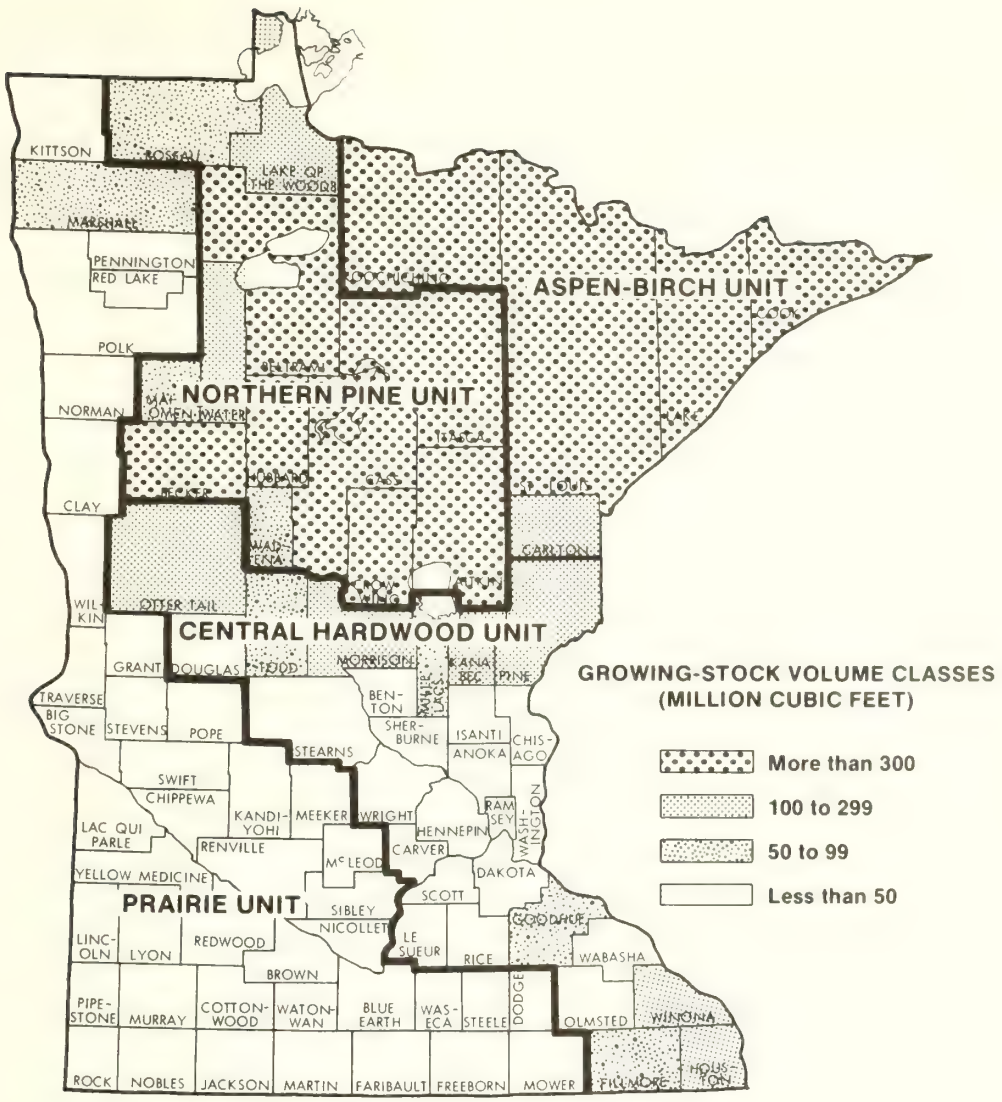


Figure 2.—*Growing-stock volume in Minnesota counties, 1977.*

mallest diameter classes than is true for hardwood volume — 51 percent of softwood growing-stock volume is in 6- and 8-inch trees, compared to 40 percent of the hardwood volume. This is true because of the large volumes in typically small-diameter softwoods — balsam fir, black spruce, and tamarack.

Thirty-one percent (1.1 billion cubic feet) of the softwood growing-stock volume is scattered throughout hardwood forest types, particularly the aspen type. For example, 36 percent of the total white spruce volume is in the aspen type and only 11 percent is in the white spruce type. And equal amounts (33 percent) of balsam fir volume are found in the aspen and balsam fir types. Conversely, only 6 percent of total hardwood volume is in softwood forest types.

Average volume per acre is highest in the white pine (1,587 cubic feet) and red pine (1,536) forest types, and lowest in the tamarack (438) and black spruce (474) types, compared to the State average of 836 cubic feet.

Seventy percent of the growing-stock volume is in stands aged 31 to 70 years (table 3). This surge in volume corresponds roughly to the swell of commercial forest area in stands aged 31 to 60, amounting to 49 percent of the total area. A much higher proportion of the volume in softwood forest types is in stands older than 90 years than is true of hardwood stands. The presence of long-lived species in the northern white-cedar, tamarack, and black spruce forest types accounts for much of the difference.

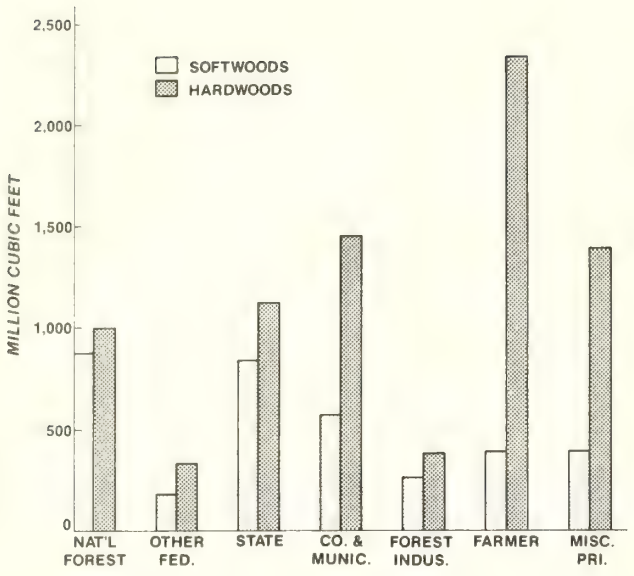


Figure 3.—*Net volume of growing stock on commercial forest land by softwoods and hardwoods and ownership class, Minnesota, 1977.*

The volume in the State's widespread aspen forest type reveals the same bulge in the 30- to 60-year classes (fig. 5). Recommended rotation age for aspen in the Lake States varies with site index and end

Table 2.—*Net volume of growing stock on commercial forest land by ownership class and softwoods and hardwoods, Minnesota, 1977*

(In million cubic feet)

Ownership class	All species	Softwoods	Hardwoods
National Forest	1,871.1	871.1	1,000.
Bureau of Land Management	37.4	22.8	14.
Indian	374.6	136.6	238.
Misc. federal	96.6	20.2	76.
State	1,942.1	818.2	1,123.
County and municipal	2,012.3	566.7	1,445.
Forest industry	636.0	265.0	371.
Farmer	2,706.2	383.6	2,322.
Miscellaneous private	1,777.7	392.8	1,384.
Total	11,454.0	3,477.0	7,977.

product. Generally, aspen on low sites (site index 0 and less) managed for fiber production is harvested t about age 35, and aspen on high sites (site index 70) managed for sawtimber is harvested at about age 0 (Perala 1977). In many areas, low site index aspn deteriorates earlier than high site aspen and should e harvested earlier As seen in figure 5, a large volume the aspen type, where 83 percent of the aspen volu is found, exists in stands more than 60 years o Therefore, large losses of aspen are undoubtec occurring.

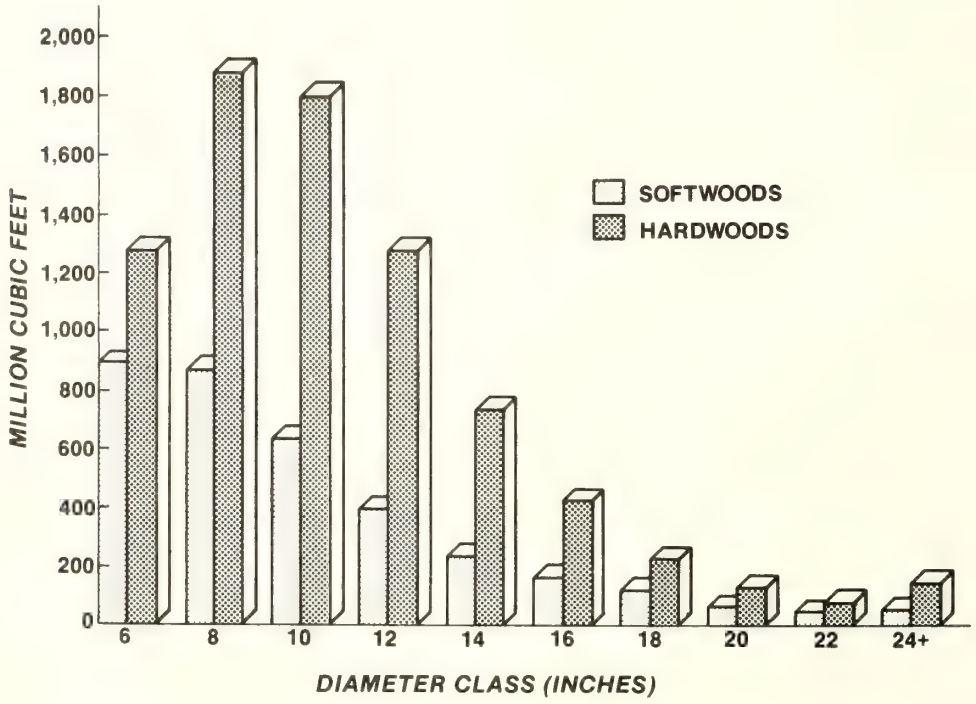


Figure 4.—*Net volume of growing stock on commercial forest land by softwoods and hardwoods and diameter class, Minnesota, 1977.*

ble 3.—*Net volume of growing stock on commercial forest land by stand-age class of softwood and hardwood forest types, Minnesota, 1977*

(In million cubic feet)

Stand-age class (years)	Forest type		
	Total	Softwood	Hardwood
0-10	241.9	27.4	214.5
11-20	280.2	62.1	218.1
21-30	431.0	113.3	317.7
31-40	1,413.5	285.2	1,128.3
41-50	2,729.8	505.8	2,224.0
51-60	2,502.8	561.8	1,941.0
61-70	1,415.2	339.1	1,076.1
71-80	921.5	326.0	595.5
81-90	568.7	185.4	383.3
91-100	501.6	217.0	284.6
101-120	259.2	107.6	151.6
121-140	185.5	115.0	70.5
141+	3.1	3.1	—
Total	11,454.0	2,848.8	8,605.2

QUALITY OF SAWTIMBER IS LOW

Three-fourths of the sawtimber in the State is in ade 3[3] logs (fig. 6), largely the result of the latively small diameters of sawtimber trees. The roportion of volume in the higher grades (1 and 2) much greater for hardwoods (22 percent) than for oftwoods (9 percent). It is not possible to accurately ompare sawtimber quality between surveys because ifferent log grade standards were used on each ccasion. However, average quality probably has not nproved much since 1962 because of the relative outh of many stands.

Species with exceptionally high proportions of sawimber volume in log grades 1 and 2 are basswood (47 ercent), elm (41), yellow birch (32), ash (30), select ed oaks (23), white pine (23), and soft maple (24).

GROWTH RATE IS 3 PERCENT

Net annual growth of growing stock declined from 64 to 349 million cubic feet from 1962 to 1976 — a 4-ercent drop. Softwood growth increased by 12 perent between surveys (from 107 to 120 million cubic feet), but hardwood growth fell by 11 percent (from 257 to 229 million cubic feet).

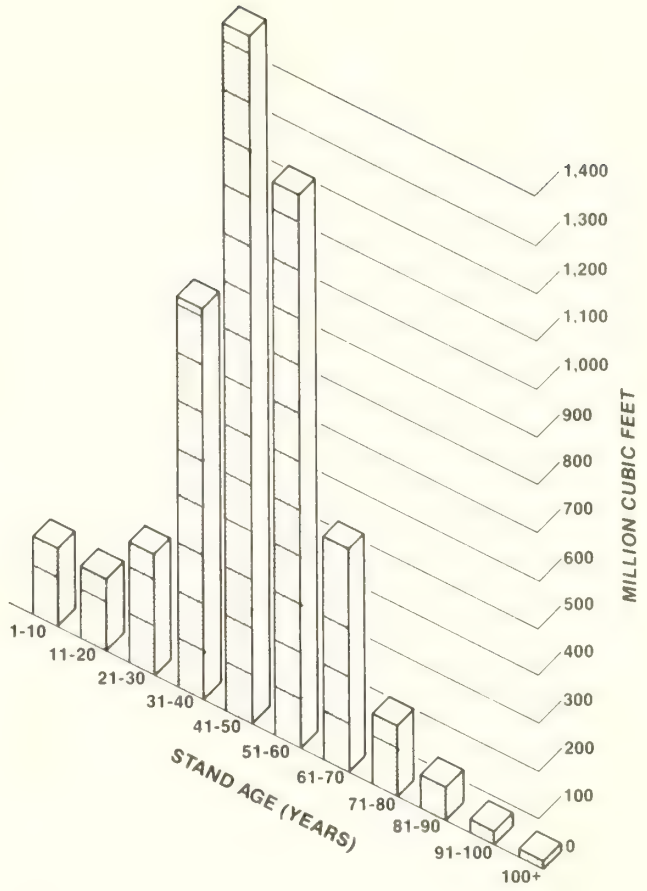


Figure 5.—*Net volume of growing stock in the aspen forest type on commercial forest land by stand-age class, Minnesota, 1977.*

The average net annual growth per acre remained nearly constant between surveys — 24 cubic feet in 1962 and 25 cubic feet in 1976.

The growth rate was 3.0 percent of inventory in 1976 and 3.9 percent in 1962. The 1976 softwood growth rate (3.4 percent) was higher than the hardwood rate (2.9 percent). Declining growth rates are to be expected in States like Minnesota where inventory volumes are expanding rapidly. For the growth rate to remain the same between surveys under such circumstances, the volume of growth would have to increase inordinately.

Practically all softwood growth volume is in the Northern Pine and Aspen-Birch Survey Units (fig. 7). Although the Northern Pine Unit accounts for the largest share of the hardwood growth, the hardwood growth rate is highest in the Central Hardwoods Unit (4.0 percent).

[3]*Third best of the four log grades used to estimate awtimber quality in Minnesota, as described further n the Appendix.*

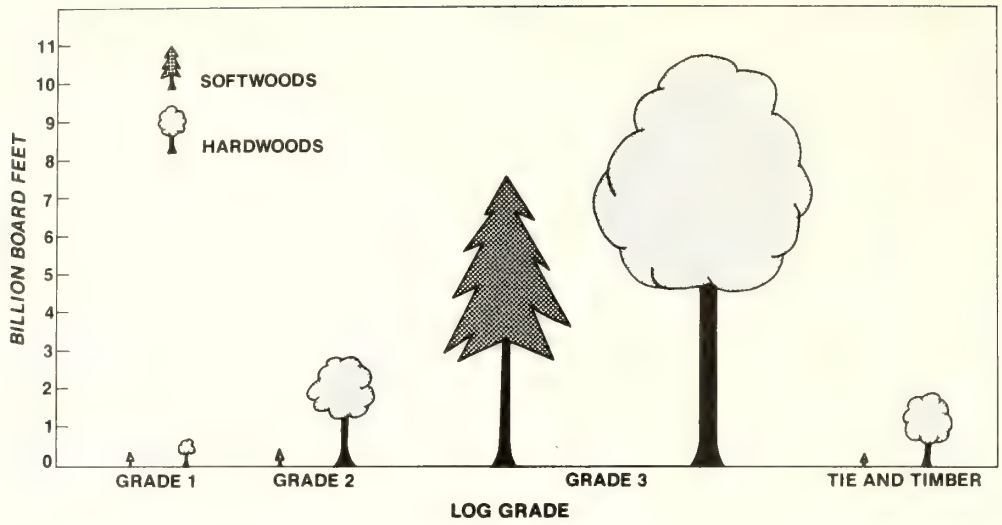


Figure 6.—*Net volume of sawtimber on commercial forest land by log grade and softwoods and hardwoods, Minnesota, 1977.*

Softwoods account for 34 percent of the volume of growth, although they represent only 30 percent of the growing-stock inventory. Hardwoods account for 66 percent of the growth volume, although they make up 70 percent of the inventory.

Growth rates on private land averaged 3.2 percent of inventory, somewhat higher than the average for public land (3.0 percent). The bulk of the softwood growth volume is on public land (fig. 8), just as most of the softwood inventory is on those lands.

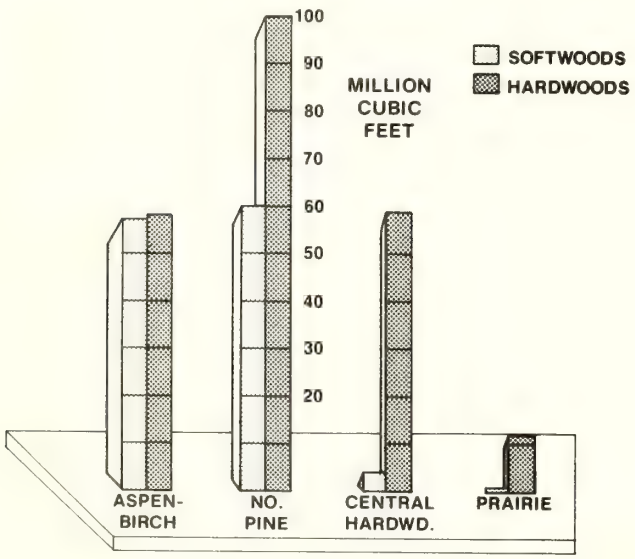


Figure 7. — *Net annual growth of growing stock on commercial forest land by softwoods and hardwoods and Forest Survey Unit, Minnesota, 1976.*

Net annual growth of sawtimber amounted to 1 billion board feet in 1976, 4.5 percent of inventory.

DISEASE IS LARGEST CAUSE OF MORTALITY

Mortality of growing-stock trees amounted to 12 million cubic feet in 1976, 1.2 percent of inventory. The mortality rate for softwoods (1.0 percent) is slightly lower than that for hardwoods (1.4 percent). The highest mortality rates are for tamarack (3 percent), aspen (2.1 percent), and balsam poplar (2 percent). Public owned forests boast the lowest mortality rates (1.1 percent), compared to privately owned forests (1.4 percent).

Disease caused 57 percent of the 1976 mortality volume, followed by weather (17 percent). All other causes accounted for the remaining 26 percent. Cause of mortality differed significantly by softwoods and hardwoods (fig 9.). Disease killed the largest volume of both softwoods and hardwoods, but it killed a much larger proportion of hardwoods (62 percent) than of softwoods (43 percent). Diseases of aspen, chiefly hypoxylon canker, account for 42 percent of the total hardwood mortality volume and for 32 percent of the total mortality of all species.

Annual mortality of sawtimber in 1976 was 20 million board feet, 1.1 percent of inventory.

TIMBER REMOVALS INCREASE — ESPECIALLY ASPEN

Timber removals from growing stock in 1976 mounted to 194 million cubic feet, an increase of one-ıird from 1962. Although removals for individual pecies varied between surveys, total softwood remov-ls remained the same:

Species	Timber removals from growing stock 1962	1976
	(Million cubic feet)	
Softwoods	68.9	68.8
Hardwoods	77.0	124.8
All species	145.9	193.6

Aspen removals increased from 45.7 million cubic eet in 1962 to 73.0 million in 1976, a 60-percent gain. As these figures suggest, industrial interest in the spen resource is heightening especially as waferboard lants under construction throughout the State begin perations. Jack pine removals were the second larg-st in the State in 1976 with 21.5 million cubic feet, lthough this was a decline of 5 percent from the 1962 evel. Spruce (17.9 million cubic feet), balsam fir (13.9 nillion), red oak (10.1 million), and paper birch (9.1 nillion) were other species with large removals volumes.

Seventy percent of the total volume of removals was used for roundwood products (135.0 million cubic eet). Other removals — trees removed but not used or products, or trees left standing but "removed" rom commercial forest classification by land use change — accounted for 28 percent of the total (53.5 million), and logging residues made up the remaining 2 percent (5.1 million).

A higher proportion of softwood removals are used for roundwood products (83 percent) than hardwood removals (63 percent).

Pulpwood is the most sought-after product in the State, representing 67 percent of the volume of round-wood products Saw logs account for 20 percent of the roundwood volume; fuelwood represents 7 percent — a figure that is expected to grow substantially in the future; and posts, poles, veneer logs, and other minor products account for the remaining 6 percent.

Forty percent of the total removals were from the Aspen-Birch Unit, which contained 39 percent of the inventory of growing stock. The Northern Pine Unit accounted for 38 percent of removals (44 percent of inventory), the Central Hardwood Unit made up 18 percent of removals (14 percent of inventory), and the Prairie Unit contributed 4 percent of removals (3 percent of inventory).

Private lands yielded 62 percent of the removals volume, but contained only 45 percent of the inventory. The 119 million cubic feet of removals from private land translate into a removals rate of 2.3 percent of inventory, compared to a rate on public land of 1.2 percent.

TIMBER REMOVALS ABOUT HALF OF GROWTH VOLUME

A comparison of 1976 timber removals with net annual growth shows that the volume of growth was almost double that of removals. However, a comparison of this kind may not be useful in States like Minnesota where stands are relatively young and growth includes a substantial volume from trees too small to be a significant part of the removals volume. A more meaningful comparison is one between removals and the yields from land managed under cutting prescriptions that represent the probable high and low range of future yields from the State. Predicted yields for all four Survey Units in Minnesota were computed and those for northern Minnesota were published (Jakes and Smith 1980). When used with other resource information, these predicted yields can identify deficiencies or surpluses in the forest resource. Yields were computed for 2 sets of prescriptions — a long rotation option based on rotation ages approximating current harvest practice, and a short rotation option that uses current empirical yields to select rotation age at the age of maximum total volume yield The long rotation option would produce both sawtimber and pulpwood; the short rotation option would produce primarily pulpwood.

A comparison of 1976 growth and removals with predicted yields from both the long and short rotation options for 1977-1986 shows that yields would be substantially greater than current removals, under certain assumptions (table 4). Average annual growing-stock removals for the decade under the long and short rotation options are 46 percent and 106 percent greater, respectively, than 1976 removals. The disparity is greater for hardwoods (54 percent and 125 percent) than for softwoods (30 percent and 73 percent). The difference between current removals and predicted yields is greatest in the Aspen-Birch Unit where average annual removals under the long rotation prescription would be nearly twice as large as 1976 removals.

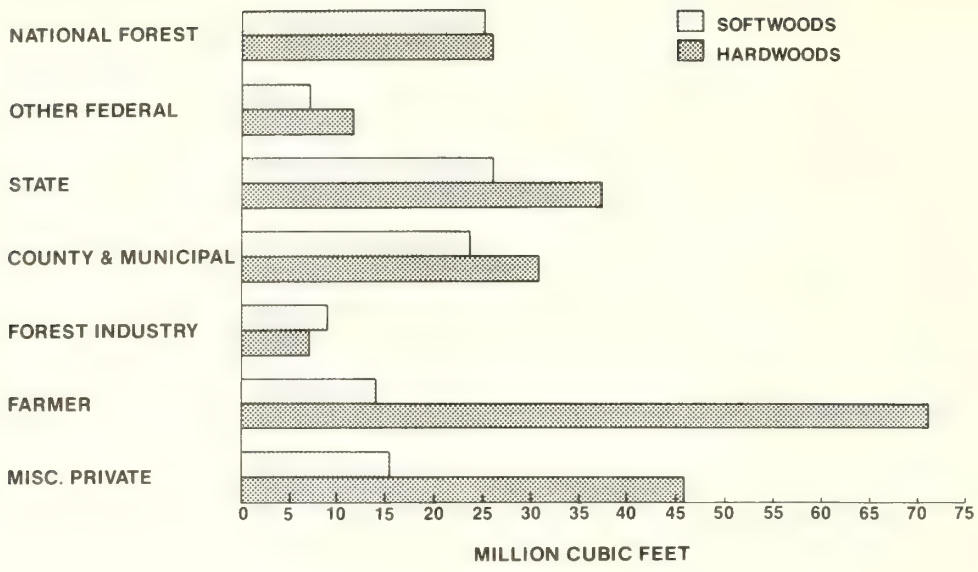


Figure 8. — *Net annual growth of growing stock on commercial forest land by softwoods and hardwoods and ownership class, Minnesota, 1976.*

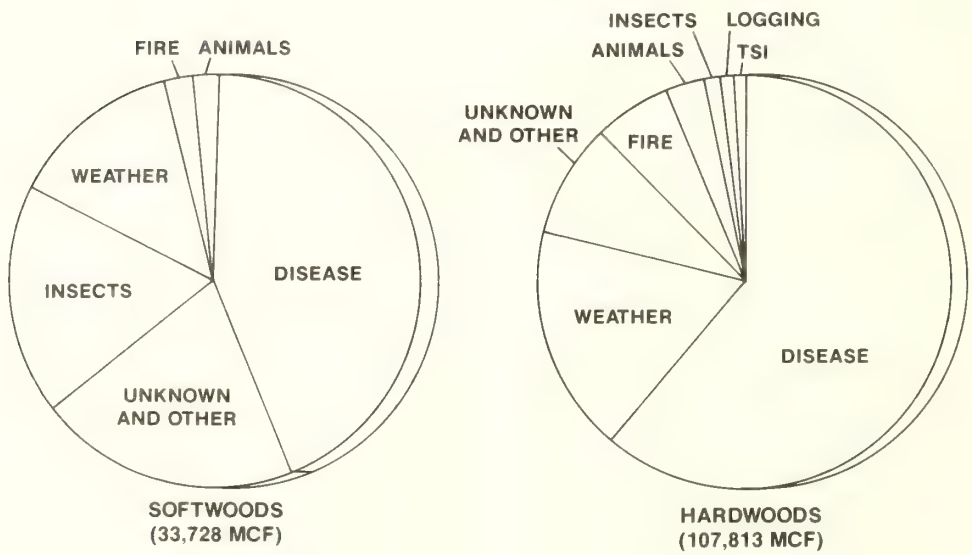


Figure 9. — *Annual mortality of growing stock on commercial forest land by softwoods and hardwoods and cause, Minnesota, 1976.*

able 4.—*Net annual growth and removals of growing stock on commercial forest land for 1976 and average annual predicted yields from selected cutting prescriptions for 1977-1986 by softwoods and hardwoods, and Forest Survey Unit, Minnesota*

(In thousand cubic feet)

pecies	Net annual growth	Annual timber removals	Predicted yields from selected cutting prescriptions: Long rotation age option	Predicted yields from selected cutting prescriptions: Short rotation age option
ALL UNITS				
oftwoods	119,781	68,800	89,378	118,915
ardwoods	229,139	124,800	192,535	280,568
ll species	348,920	193,600	281,913	399,483
ASPEN-BIRCH UNIT				
oftwoods	56,982	38,803	54,866	71,142
ardwoods	57,917	38,445	93,608	117,588
ll Species	114,899	77,248	148,474	188,730
NORTHERN PINE UNIT				
oftwoods	59,123	28,502	33,117	45,354
ardwoods	100,669	44,926	72,303	103,273
ll species	159,792	73,428	105,420	148,627
CENTRAL HARDWOODS UNIT				
oftwoods	3,562	1,339	1,269	2,246
lardwoods	58,733	32,858	20,410	51,862
ll species	62,295	34,197	21,679	54,108
PRAIRIE UNIT				
oftwoods	114	156	126	173
lardwoods	11,820	8,571	6,214	7,845
ll species	11,934	8,727	6,340	8,018

The predicted yields are based on the following assumptions: (1) all landowners are willing to sell their timber, (2) operability (the physical conditions that determine whether a stand can be harvested) and availability of timber stands are not obstacles to timber harvesting, and (3) markets exist for all commercial species. Because these assumptions represent ideal rather than existing conditions, the yields in table 4 should be discounted accordingly.

PROJECTIONS OF NATIONAL TIMBER SUPPLY

The most recent projection of national demand for roundwood shows consumption increasing from 13.3 billion cubic feet in 1976 to 25.2 billion in 2010, an 89-percent jump (USDA Forest Service 1980). Softwood demand is projected to grow from 10.3 to 17.7 billion cubic feet during the same period — a 72-percent gain, but hardwood demand is projected to jump from 3.0 to 7.5 billion cubic feet — a 150-percent increase. The faster rate of growth for hardwoods reflects a projected rise in demand for hardwood pulp products, hardwood lumber for pallets and railroad ties, and hardwood plywood and veneer for furniture. This projection, made at a medium level of population and economic growth, assumes that the price trends in the base period used in making the projection (roughly from the late 1950's through the mid 1970's) continue through the projection period.[4] When the excess of roundwood imports (4.5 billion cubic feet) over exports (1.5 billion) is subtracted from the projected demand in 2010, the result is the demand on United States forests — 22.2 billion cubic feet.

National supplies (timber available for harvest) of roundwood are projected to increase from 12.1 to 18.7 billion cubic feet between 1976 and 2010.[5] Softwood supplies are projected to increase from 9.2 to 11.6 billion cubic feet during the period, but hardwood supplies vault from 2.9 to 7.1 billion cubic feet. Projected demand on United States forests in 2010 exceeds supply by 3.5 billion cubic feet. The short-fall for softwoods (3.3 billion) is much larger than that for hardwoods (0.2 billion).

MINNESOTA'S TIMBER PROJECTIONS

Minnesota's timber resource will play a significant, though not major, role in the Nation's demand-supply outlook. A look at what is likely to happen to the State's future timber resource under several levels of removals can help put Minnesota in perspective with the Nation.

Two 30-year projections of the State's timber situation were made using the Timber Resource Analysis System (TRAS) program (USDA Forest Service 1970). One assumes a continuation of recent levels of timber removals (low removals option), and the other assumes a higher level of removals (high removals

[4] *Another projection was made under the assumption that prices will rise enough to maintain an equilibrium between projected demand and supply.*

[5] *Projection shows the volume of timber available for harvest from domestic forests if recent trends in the forces determining supply, such as commercial timberland area, management, and prices, continue through the projection period.*

option). Separate projections were made for softwoods and for hardwoods. TRAS uses a stand projection technique involving input of number of trees, growth rates, mortality rates, and removal rates, all by 2-inch diameter classes, along with assumed total removals by year and assumed ingrowth into the 2-inch diameter class.

Assumptions common to both options are: (1) the total area of commercial forest land will decline at an annual rate of 0.310 percent, from 13.7 million acres in 1977 to 12.4 million acres in 2007; (2) radial growth will decline in relation to the increase of basal area per acre of trees; (3) the intensity of forest management will continue at the rate indicated by recent trends; (4) the volume of "other" removals will drop during the period as more of these trees are utilized for products.

LOW REMOVALS OPTION PROJECTION

The low option assumes that softwood timber removals will increase at an average annual rate of 2.68 percent or 1.9 million cubic feet, and that hardwood removals will increase at an average annual rate of 2.73 percent or 3.5 million cubic feet. Growth is projected to exceed removals, to peak about 1987, and then to turn down. Therefore, inventory is projected to increase at an average annual rate of 1.11 percent or 128 million cubic feet, but to increase less rapidly during the last 15 years (fig. 10).

This projection shows removals increasing from 198 million cubic feet in 1977 to 360 million in 2007, an 81-percent gain. Softwood removals are projected to increase from 71 to 128 million cubic feet during the period, and hardwood removals are projected to expand from 128 to 232 million cubic feet. Removals for the major roundwood products — pulpwood, saw logs, and fuelwood — are all assumed to rise during the projection period but more of these products are assumed to be recovered from "other" removals. The construction of waferboard plants in the State is assumed to have a noticeable impact on hardwood removals.

Growth is projected to increase from 349 million cubic feet in 1977 to 432 million in 1987, then to decline to 375 million in 2007. At the beginning of the projection period, the surplus of growth over removals is 151 million cubic feet. By 1987 the surplus is projected to be 180 million cubic feet, but by 2007 it is projected to shrink to 16 million.

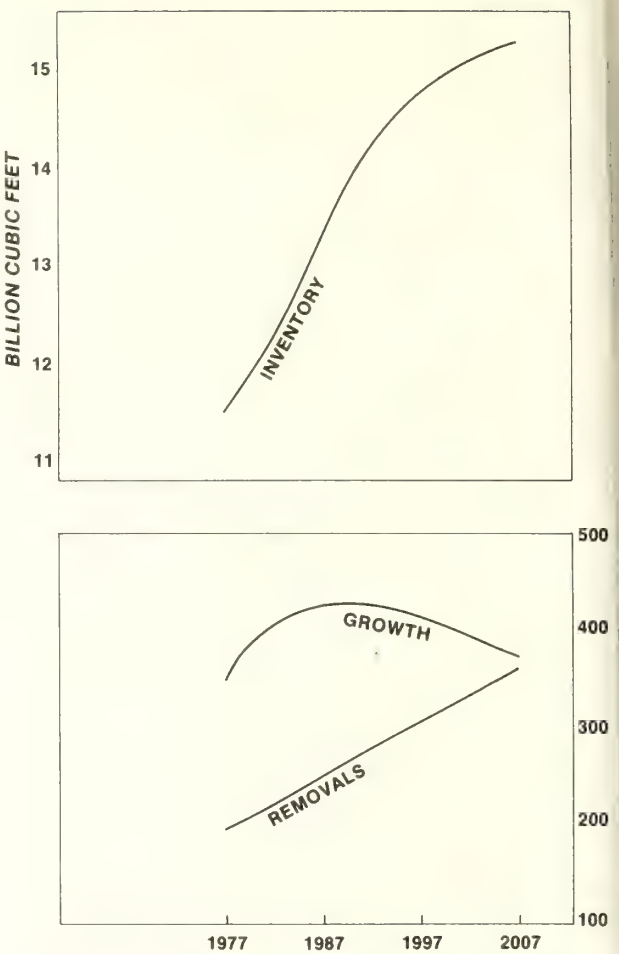
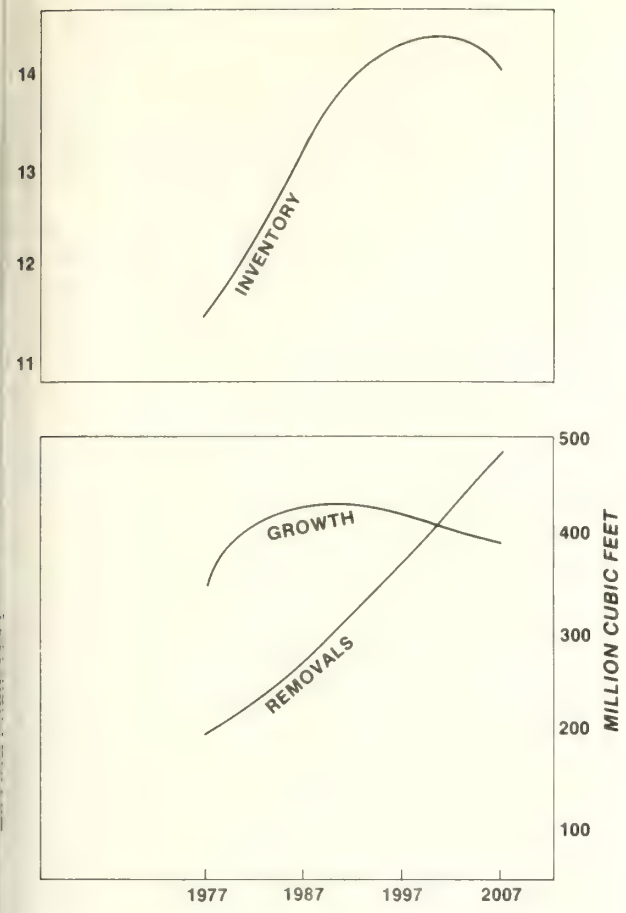


Figure 10.—*Removals, net growth, and inventory of growing stock in Minnesota, 1977, and low removals option projection for 1977-2007.*

The 1977 inventory of 11.5 billion cubic feet is projected to rise to 15.3 billion in 2007, a 33-percent gain. The rise of the inventory curve slows as the growth and removals curves converge, and the annual increase in inventory is projected to almost cease by 2000 when the growth and removals curves nearly cross.

HIGH REMOVALS OPTION PROJECTION

Timber removals under this option are assumed to increase at an annual rate of 4.45 percent or 3.5 million cubic feet for softwoods and to increase at an annual rate of 4.99 percent or 6.4 million cubic feet for hardwoods. Removals surpass growth about 2000 and widen their lead through 2007. Inventory is projected to increase more slowly as growth and removals converge and to turn down when the two curves bisect (fig. 11).



igure 11.— *Removals, net growth, and inventory of growing stock in Minnesota, 1977, and high removals option projection for 1977-2007.*

Under the high removals option, removals jump rom 199 to 486 million cubic feet between 1977 and 007, a 144-percent gain. Softwoods are projected to ncrease from 71 to 166 million cubic feet and hardoods from 128 to 320 million cubic feet. This option ssumes more expanded markets for roundwood prodcts than the low removals option does.

The 1977 growth of 349 million cubic feet is projectd to rise to 432 million by 1987, then to sag to 393 nillion by 2007. The excess of growth over removals of 50 million cubic feet in 1977 is projected to enlarge to 62 million in 1987, then to do an about-face and end vith a removals surplus of 93 million cubic feet in 007.

Inventory rises from 11.5 to 14.2 billion cubic feet etween 1977 and 1997. Then, in response to the videning imbalance of removals over growth and a hrinking commercial forest land base, it begins to lecline about 2000 and reaches 14.0 billion cubic feet n 2007 — a net rise from 1977 of 22 percent.

THE OUTLOOK

The low and high removals options represent the forest situation only if the assumptions upon which they are based are realized. The projections are not intended to convey what is desirable from silvicultural, economic, or social viewpoints; they are simply indicators of what is likely to happen if forests are managed much as they have been for the last 15 years and if harvesting occurs at two different levels. Projections for the first decade are the most meaningful because fast-changing market and economic conditions can quickly nullify the assumptions under which projections for the last two decades were made.

Inventory, then, is likely to continue accumulating for the next decade at a rate similar to that of recent trends. After that, inventory will increase more slowly and, depending on such factors as rate of loss of commercial forest land and rate of timber removals, it will stabilize or decline. A more intensive level of timber management than that assumed could lead to increased timber growth and larger-than-projected inventories. Timber stand treatment opportunities in the State during 1977-1986 are discussed in "Projecting Treatment Opportunities for Current Minnesota Forest Conditions" (Smith and Jakes 1981). Timber supplies might also be extended through more complete utilization of residues, treetops, and limbs, the volumes of which are not included in timber inventories. Inventories would also be larger than projected if the actual area of commercial forest land converted to other uses is less than assumed or if much of the land converted is of low site quality.

What happens to the large area of aspen forest type in the State (39 percent of the commercial forest area) will have a major impact on Minnesota's future forest resource. If aspen stands are not disturbed, such as by logging or fire, they tend to be replaced by more shade-tolerant or longer-lived species. A coniferous understory was present in 27 percent of the aspen stands in 1977. By 2007 many of these stands could be converted by natural succession to softwood types such as balsam fir, spruce, and pine, unless the stands are logged or burned. The accelerating industrial interest in aspen, however, probably means that fewer aspen stands will remain undisturbed. Other aspen stands with tolerant hardwood understories will convert to the northern hardwoods type by natural succession also. The outlook, then, is for the area of the aspen type and its associated volumes to shrink somewhat in the future.

It seems likely that the volume of red and white pines, species traditionally preferred for lumber in the

State, will decline in the future. The areas of these forest types continue to diminish despite the amount of past red pine plantings.

Whatever happens to Minnesota's maturing forests will be largely determined by the attitudes of the State's nonindustrial private forest landowners who control 41 percent of the commercial forest land and 39 percent of the growing-stock volume. Policies that seek to bring practical, technical information and assistance on forest management to these owners will help to achieve a more favorable future timber outlook for the State. And policies that make timber-growing more profitable for these owners will have the same effect. Expanded markets for timber products and financial incentives, such as tax incentives for forest landowners and cost-share programs for tree planting and timber stand improvement, are some ways to make enlightened timber management more attractive to these owners.

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APPENDIX

ACCURACY OF SURVEY

Resources Evaluation information is based on a sampling procedure designed to provide reliable statistics at the State and Survey Unit levels. Consequently, the reported figures are estimates only. Sampling errors give a measure of reliability of these figures. These sampling errors mean that the chances are two out of three that if a 100-percent inventory had been taken using the same methods, the results would have been within the limits indicated.

For example, the estimated growing-stock volume in Minnesota in 1977, 11,454.0 million cubic feet, has a sampling error of ± 1.04 percent (± 119,122 thousand cubic feet). The growing-stock volume from a 100-percent inventory, then, would be expected to fall between 11,573.1 and 11,334.9 million cubic feet (11,454.0 ± 119.1), there being a one in three chance that this is not the case.

Sampling errors were calculated separately for National Forest land because of the lower sampling intensity there. For example, the sampling error for growing-stock volume on land other than National Forest is ± .82 percent but for Chippewa National Forest land it is ± 7.47 percent.

The following tabulation shows the combined sampling errors for the 1977 Minnesota Forest Inventory:

Item	Minnesota totals	Sampling error (Percent)
Growing stock	(Million cubic feet)	
Volume	11,454.0	1.04
Growth	348.9	1.42
Removals	193.6	5.33
Sawtimber	(Million board feet)	
Volume	24,607.2	1.85
Growth	1,111.5	1.72
Removals	460.3	4.36
Commercial forest land	(Thousand acres) 13,695.1	0.39

As survey data are broken down into sections smaller than State or Survey Unit totals, the sampling error increases. The smaller the breakdown, the larger the sampling error. For example, the sampling error for growing-stock volume in a particular county is higher than that for growing-stock volume in the Survey Unit (table 51 shows the sampling errors for estimates smaller than State totals).

SURVEY PROCEDURE

The major steps in the Minnesota survey were as follows:

1. A total of 276,897 1-acre points were systematically distributed across aerial photos of the entire State, except the Chippewa and Superior National Forests. These points were classified as forest land (72,700), unproductive forest land (4,483), nonforest land (197,674), or questionable (2,040) to make a preliminary estimate of forest area. Next, all forest points (72,700), 592 of the unproductive forest points, and all questionable points (2,040) were stereoclassified as to forest type, stand-size class, and density. Then 9,796 points classed as forest, 592 points classed as unproductive, 276 points classed as questionable, and 25,498 points classified as nonforest were examined on the ground to correct the preliminary area estimate for errors in classification and for actual changes in land use since the photos were taken. At each of the 8,547 commercial forest locations, variable-radius plots (basal area factor 37.5) were established at 10 points uniformly placed over the sample acre. Tree measurements made at these locations were the basis for estimates of timber volume, growth, mortality, number of trees, and other forest classifications.

2. Growth and mortality on all commercial forest land were estimated[6] using the Stand and Tree Evaluation and Modeling System (STEMS). STEMS is an individual tree-growth projection system that uses the following stand and tree characteristics to grow trees by updating tree diameter and tree status (live, dead or cut): species, tree diameter, crown ratio, site index, basal area, and average stand diameter. These characteristics were used to produce growth and mortality rates that were adjusted based on ground conditions gained from remeasurement of plots and applied to trees on the tree list to yield an updated tree list. Local volume equations were applied to the original and updated tree lists to estimate volumes of growth and mortality.

[6] *STEMS was developed at the North Central Forest Experiment Station as part of the Forest Resources Evaluation Program (FREP). For more information on STEMS, see: Belcher et al. 1981.*

3. Data from the National Forests were incorporated into the Survey data. Area statistics for the Chippewa National Forest were prepared by the Chippewa's Timber Management staff from compartment examination records. In 1975, the Forest conducted its own inventory using the standard forest inventory system. Data from these plots were used as input for STEMS, which was modified and used to update volumes to 1977. The updated Chippewa National Forest data were approved by the Forest and combined with Survey data from non-National Forest commerical forest land to estimate volume, growth, and mortality for the State.

Area statistics for the Superior National Forest were prepared by the Superior's Timber Management staff from compartment examination records. Volume data for Superior National Forest land were prepared from permanent sample plots established by Forest personnel. Superior National Forest data, were then added to data for the rest of the State computed from 10-point variable radius plots.

4. Statistics on timber utilization during 1975 were obtained from mill surveys. The Minnesota Department of Natural Resources and the North Central Forest Experiment Station canvassed State sawmills, veneer mills, and other primary wood-using plants. The North Central Station canvassed State pulpmills, as well as out-of-State sawmills, pulpmills, and veneer mills to determine their use of timber from Minnesota. Fuelwood and fencepost output was based on a sample of private landowners and on a canvass of industrial and public timber owners. Estimates of primary mill residue used for fuelwood were obtained from the canvass of Minnesota primary wood-using plants. Timber cut for products was determined for each ownership class by a canvass of public and industrial timber owners. The portion of timber cut unaccounted for by the latter owners was grouped under "farmer and other owners."

5. A total of 1,028 felled trees on 80 active logging operations were measured throughout the State during 1975-1976 to develop wood utilization factors for converting timber products output to timber removals for saw logs and pulpwood. Factors for veneer logs were obtained during the 1967-1968 Wisconsin utilization study. Factors for all other products were obtained during the 1960-1961 Minnesota utilization study.

6. Field data were sent to St. Paul and compiled.

COMPARING MINNESOTA'S FOURTH SURVEY WITH THE THIRD SURVEY

Data from new forest surveys are often compar with data from earlier ones to determine trends forest areas and volumes. Changes in procedures a definitions between surveys make it necessary to a just earlier data to make them comparable.

Because the Unit boundaries in Minnesota chang between surveys, the 1962 commercial forest area da were adjusted to take these changes into accou Then, a portion of the 1962 commercial forest ar was withdrawn and added to unproductive fore (noncommercial) and to nonforest to allow f changes in the method of determining land uses. T resulting adjusted 1962 commercial area was th used to adjust 1962 inventory, net growth, and morta ity volumes.

A test was made to ensure that it was possible move from the adjusted 1962 volumes to the new 19 volumes by means of Timber Resource Analysis Sy tem (TRAS), a Forest Service computer program f updating, backdating, and projecting timber volum growth, mortality, and removals. For the program work, the 2 years to be reconciled must have compar ble commercial forest land bases so that changes i volumes between surveys reflect actual changes i forest conditions or land use. Therefore, it was nece sary to adjust the 1962 data further so that lan transferred from commercial forest to productiv reserved between the two surveys would not appear i the 1962 land base. If this adjustment were not mad removals between 1962 and 1977 would appear artif cially high to absorb the loss of timber from th change in land status. This adjustment was made f the test only; area and volumes removed for the te were added back into the 1962 reported data.

TRAS recalculated 1962 volumes using 1977 est mates of cubic foot volume per tree and 1977 boar foot-cubic foot ratios. This volume adjustment wa necessary so that volume differences between survey represented actual change and not merely change i the volume equations used on each occasion.

The adjusted 1962 volumes and area were distribut ed among the four Survey Units. A check was made t ensure that it was possible to move from the adjuste 1962 volumes to the new 1977 volumes in each Unit

This was done using the average periodic difference between growth and removals for the two surveys and applying this difference to the 1962 volume. The same procedure was repeated for each individual species within each Unit to make sure inventory volumes reported for each species were consistent with reported growth and removals volumes.

Removals estimates for 1962 and 1977 are for total removals, including timber cut in addition to "other" removals, and are trend level removals. "Other" removals from transfer of commercial forest land to productive-reserved are not included. Previously published 1960 estimates are of timber cut only and do not include "other" removals. TRAS generated an estimate of 1962 "other" removals to provide the adjusted 1962 total removals.

LOG GRADE

In Minnesota the butt log of every sawtimber tree on every full permanent sample plot (12,994 trees) was graded for quality. Also graded were all logs in a smaller sample of trees throughout the State (1,028 trees). The volume yield by log grade for each tree in this smaller sample was used to distribute the volume of trees in the larger sample into log-grade classes. The resulting volumes by log-grade classes were expanded to provide an estimate for the entire State.

Logs were graded on the basis of external characteristics. Hardwood species were graded according to "Hardwood Log Grades for Standard Lumber" (Vaughn *et al.* 1966). The best 12-foot section of the lowest 16-foot hardwood log, or the best 12-foot upper section if the butt log did not meet minimum log-grade standards, was graded as follows:

Forest Service standard grades for hardwood factory saw logs

Grading Factors		Specifications							
		Log grade 1			Log grade 2				Log grade 3
Position in tree		Butts only	Butts and uppers		Butts and uppers				Butts and uppers
Scaling diameter, inches		[1]13-15	16-19	20+	[2]11+		12+		8+
Length without trim, feet			10+		10+	8-9	10-11	12+	8+
	Min. length, feet	7	5	3	3	3	3	3	2
Required clear cuttings[3] each of three best faces[4]	Max. number	2	2	2	2	2	2	3	No limit
	Min. proportion of log length required in clear cutting	5/6	5/6	5/6	2/3	3/4	2/3	2/3	1/2
Maximum sweep & crook allowance	For logs with less than one-fourth of end in sound defects		15 percent				30 percent		50 percent
	For logs with more than one-fourth of end in sound defects		10 percent				20 percent		35 percent
Maximum scaling deduction			40 percent[5]				50 percent[6]		50 percent

[1]Ash and basswood butts can be 12 inches if they otherwise meet requirements for small #1's.
[2]Ten-inch logs of all species can be #2's if they otherwise meet requirements for small #1's.
[3]A clear cutting is a portion of a face, extending the width of the face, that is free of defects.
[4]A face is one-fourth of the surface of the log as divided lengthwise.
[5]Otherwise #1 logs with 41-60 percent deductions can be #2.
[6]Otherwise #2 logs with 51-60 percent deductions can be #3.

Forest Service standard specifications for hardwood construction logs (tie and timber logs)[1]

Position in tree		Butt and upper
Min. diameter, small end		8 inches+
Min. length, without trim		8 feet
Clear cuttings		No requirements
Sweep allowance, absolute		One-fourth of the diameter of the small end for each 8 feet of length.
Sound surface defects	Single knots	Any number, if no one knot has an average diameter above the callus in excess of one-third of log diameter at point of occurrence.
	Whorled knots	Any number if sum of knot diameters above the callus does not exceed one-third of log diameter at point of occurrence.
	Holes	Any number, provided none has a diameter over one-third of log diameter at point of occurrence, and none extends over 3 inches into included timber.[2]
Unsound surface defects		Same requirements as for sound defects if they extend into included timber.[2] No limit if they do not.
End defects	Sound	No requirements.
	Unsound	None allowed; log must be sound internally, but will admit one shake not to exceed one-fourth of the scaling diameter and will admit a longitudinal split not extending more than 5 inches into the contained timber.

[1]These specifications are minimum for the class. If, from a group of logs, factory logs are selected first, thus leaving only nonfactory logs from which to select construction logs, then the quality range of the construction logs selected is limited, and the class may be considered a grade. If selection for construction logs is given first priority, then it may be necessary to subdivide the class into grades.

[2]Included timber is always square, and dimension is judged from small end.

Softwood species were graded according to te specifications on the following page.

Log Grades for Eastern White Pine

Log grade	Minimum size Diameter	Minimum size Length[1]	Sweep or crook allowance	Total cull allowance including sweep	Maximum weevil injury	Allowable knot size (inches)[2] on three best faces or minimum clearness on four faces
	(inches)	*(feet)*	*----(percent)----*		*(number)*	*(inches)*
1	12 & 13	8-16	20	50	0	Four faces clear full length
	14+	10-16	20	50	0	Two faces clear full length, or four faces clear 50% length (6 feet min. length) or[3]
2	6+	8-16	30	50	0	Sound knots 1.e[4] D/6 and less than 3 inches.[5] Unsound knots: 1.e 1-1/2 inches and for: butt, lots 1.e. D/12, upper logs 1.e. D/10, or four faces clear 50 percent of length
3	6+	8-16	40	50	8 foot logs: 1 weevil 10 foot+ logs: 2 weevils	Sound knots 1.e. D/3 and less than 5 inches. Unsound knots 1.e. D/6 and less than 2-1/2 inches.
4	6+	8-16	50	50	No limit	No limit

[1]Plus trim.
[2]Disregard all knots less than 1/2-inch diameter in all grades.
[3]The sum of the diameter of sound knots plus twice the sum of the diameter of unsound knots (in inches) is less than or equal to half of he diameter of the log (inches).
[4]1.e. means less than or equal to.
[5]D means d.i.b. of log at knot.

Log Grades for Jack Pine and Red Pine

Grade 1: logs with three or four clear faces.[7]

Grade 2: logs with one or two clear faces.

Grade 3: logs with no clear faces.

After the tentative log grade is established, the log will be degraded one grade for sweep or heart rot. No log can be degraded below grade 3. Net scale after deduction for defect must be at least 50 percent of the gross contents of the log.

1. *Sweep.* Degrade any tentative 1 or 2 log one grade if sweep amounts to 3 or more inches and equals or exceeds one-third the diameter inside bark at small end.

2. *Heart rot.* Degrade any tentative 1 or 2 log one grade if conk, massed hyphae, or other evidence of advanced heart rot is found.

[7]*A face is one-fourth of the circumference in width extending full length of the log. Clear faces are those free of knots measuring more than 1/2-inch in diameter, overgrown knots of any size, or holes more than 1/4-inch in diameter. Faces may be rotated to obtain the maximum number of clear ones.*

Log Grades for All Other Softwood Logs

Grade 1

1. Logs must be 16 inches or larger, 10 feet or longer,

and with deduction for defect not over 30 percent of gross scale.
2. Logs must be at least 75 percent clear on each of three faces.
3. All knots outside clear cutting must be sound and not more than 2-1/2 inches in diameter.

Grade 2

1. Logs must be 12 inches or larger, 10 feet or longer, and with a net scale after deduction for defect of at least 50 percent of the gross contents of the log.
2. Logs must be at least 50 percent clear on each of three faces or 75 percent clear on two faces.

Grade 3

1. Logs must be 6 inches or larger, 8 feet or longer, and with a net scale after deduction for defect of at least 50 percent of the gross contents of the log.

Note: (A) Diameters are d.i.b. at small end of log.

(B) Percent clear refers to percent clear in one continuous section.

PRINCIPAL TREE SPECIES GROUPS IN MINNESOTA (Little 1979)

SOFTWOODS	
Eastern white pine	*Pinus strobus*
Red pine	*Pinus resinosa*
Jack pine	*Pinus banksiana*
Black spruce	*Picea mariana*
White spruce	*Picea glauca*
Balsam fir	*Abies balsamea*
Tamarack	*Larix laricina*
Northern white-cedar	*Thuja occidentalis*
Other softwoods:	
Eastern redcedar	*Juniperus virginiana*
Scotch pine	*Pinus sylvestris*
HARDWOODS	
White oaks:	
White oak	*Quercus alba*
Bur oak	*Quercus macrocarpa*
Swamp white oak	*Quercus bicolor*
Select red oak:	
Northern red oak	*Quercus rubra*
Other red oaks:	
Black oak	*Quercus velutina*
Northern pin oak	*Quercus ellipsoidalis*
Hickories:	
Shagbark hickory	*Carya ovata*
Bitternut hickory	*Carya cordiformis*
Yellow birch	*Betula alleghaniensis*
Hard maples:	
Sugar maple	*Acer saccharum*
Black maple	*Acer nigrum*
Soft maples:	
Red maple	*Acer rubrum*
Silver maple	*Acer saccharinum*
Ashes:	
White ash	*Fraxinus americana*
Black ash	*Fraxinus nigra*
Green ash	*Fraxinus pennsylvanica*
Balsam poplar	*Populus balsamifera*
Paper birch	*Betula papyrifera*
Aspens:	
Bigtooth aspen	*Populus grandidentata*
Quaking aspen	*Populus tremuloides*
Basswood	*Tilia americana*
Elms:	
American elm	*Ulmus americana*
Slippery elm	*Ulmus rubra*
Rock elm	*Ulmus thomasii*
Select hardwoods:	
Butternut	*Juglans cinerea*
Black walnut	*Juglans nigra*
Black cherry	*Prunus serotina*
Other hardwoods:	
Boxelder	*Acer negundo*
River birch	*Betula nigra*
Hackberry	*Celtis occidentalis*
Eastern cottonwood	*Populus deltoides*
Black willow	*Salix nigra*
Kentucky coffeetree	*Gymnocladus dioicus*

METRIC EQUIVALENTS OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hecta
1,000 acres = 405 hectares.
1,000 board feet (International 1/4-inch log rule) = 3.48 cubic meters.
Breast height = 1.4 meters above the ground.
1 cubic foot = 0.0283 cubic meter.
1 foot = 30.48 centimeters or 0.3048 meter.
1 inch = 25.4 millimeters, 2.54 centimeters, or 0.02 meter.

DEFINITION OF TERMS

Land-use Classes

Gross area. — The entire area of land and wat as determined by the Bureau of Census, 1970.

Land area. — The area of dry land and land temporarily or partially covered by water such as marshes, swamps, flood plains, streams, sloughs, and estuaries. Canals less than 1/8-mile wide, and lakes, reservoirs, and ponds smaller than 40 acres are included as land area. These figures are from the Bureau of Census, 1970.

Forest land. — Land at least 16.7 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Includes afforested areas. The minimum forest area classified was 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas were classed as forest if less than 120 feet wide.

Commercial forest land. — Forest land that is producing or is capable of producing crops of industrial wood and that is not withdrawn from timber utilization by statute or administrative regulation. This includes areas capable of producing in excess of 20 cubic feet per acre of annual growth. This includes both inaccessible and inoperable areas.

Noncommercial forest land. — (a) **Unproductive** — forest land incapable of yielding crops of industrial wood because of adverse site conditions, (b) **Productive-reserved** — forest land withdrawn from commercial timber use through statute or administrative regulation, or exclusively used for Christmas tree production.

Nonforest land. — Land that has never supported forests, and land formerly forested where use is precluded by development for nonforest uses, such as cropland, improved pasture, residential areas, and city parks. Also includes improved roads and adjoining rights-of-way, powerline clearings, and certain areas of water classified by the Bureau of Census as land. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide, and clearings in forested areas must be more than 1 acre in size, to qualify as nonforest land.

Ownership Classes

National forest. — Federal land that has been designated by executive order or statute as National Forests or purchase units and other land under the administration of the USDA Forest service.

Other Federal. — Federal land other than National Forest.

State, county, and municipal. — Land owned by States, counties, or local public agencies, or land leased by them for more than 50 years.

Indian. — Tribal lands held in fee but administered by the federal government.

Forest industry. — Land owned by companies or individuals operating primary wood-using plants.

Farmer-owned. — Land owned by operators of farms. A farm must include 10 or more acres from which the sale of agricultural products totals $50 or more annually, or if less than 10 acres, the yield must be at least $250 annually.

Farmer-owned, leased. — Land owned by operators of farms but leased to other parties.

Miscellaneous private-corporation. — Land owned by a private corporation not in the business of operating primary wood-using plants.

Miscellaneous private-individual. — Land owned by a private individual.

Miscellaneous private-corporation, leased. — Land owned by private corporations but leased to other parties.

Miscellaneous private-individual, leased. — Land owned by private individuals but leased to other parties.

Tree Classes

All live trees. — Growing-stock, rough, and rotten trees 1 inch d.b.h. and larger.

Growing-stock trees. — All live trees of commercial species except rough and rotten trees.

Desirable trees. — Growing-stock trees having no serious quality defects that would limit present or prospective use, possessing relatively high vigor, and containing no pathogens that may kill or seriously damage them before rotation age. These are trees that would be favored by forest managers in silvicultural operations.

Acceptable trees. — Trees meeting the standards for growing stock but not qualifying as desirable trees.

Sawtimber trees. — Growing-stock trees of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs, each 8 feet or longer. At least 33 percent of the gross volume of the tree must be sound wood. Softwoods must be at least 9 inches d.b.h. and hardwoods at least 11 inches d.b.h.

Poletimber trees. — Growing-stock trees of commercial species at least 5 inches d.b.h. but smaller than sawtimber size and of good form and vigor.

Saplings. — Live trees of commercial species 1 to 5 inches d.b.h. and of good form and vigor.

Seedlings. — Live trees of commercial species less than 1 inch d.b.h. that are expected to survive according to regional standards (examples of seedlings not expected to survive are those that are diseased or heavily damaged by logging, browsing, or fire). Only softwood seedlings more than 6 inches tall and hardwood seedlings over 1 foot in height are counted.

Rotten trees. — Live trees (any size) of commercial species that do not contain a merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of rot (that is, when more than 50 percent of the cull volume of the tree is rotten).

Rough trees. — Live trees that do not contain at least one merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of roughness and poor form. Includes all live noncommercial species.

Short-log (rough trees). — Sawtimber-sized trees of commercial species that contain at least one merchantable 8- to 11-foot saw log but not a 12-foot saw log.

Stocking

The degree of utilization of land by trees as measured in terms of basal area and/or the number of trees in a stand compared to the basal area and/or number of trees required to utilize fully the growth potential of the land.

A stocking percent of 100 indicates full utilization of the site and is equivalent to 80 square feet of basal area per acre in trees 5 inches d.b.h. and larger. In a stand of trees less than 5 inches d.b.h., a stocking percent of 100 would indicate that the present number of trees is sufficient to produce 80 square feet of basal area per acre when the trees reach 5 inches d.b.h.

Stocking of all live trees, growing-stock trees, and desirable trees are recorded separately and stands are grouped into the following stocking classes.

Stocking Classes

Overstocked stands. — Stands in which stocking of trees is 133 percent or more.

Fully-stocked stands. — Stands in which stocking of trees is from 100 to 133 percent.

Medium-stocked stands. — Stands in which stocking of trees is from 60 to 100 percent.

Poorly-stocked stands. — Stands in which stocking of trees is from 16.7 to 60 percent.

Nonstocked areas. — Commercial forest land on which stocking of trees is less than 16.7 percent.

Stand-size Classes

Stand. — A growth of trees on a minimum of 1 acr of forest land that is stocked by forest trees of any siz

Sawtimber stands. — Stands at least 16.7 per cent stocked with growing-stock trees, at least half o which are sawtimber or poletimber trees, an sawtimber stocking at least equal to that of pole timber.

Poletimber stands. — Stands at least 16.7 per cent stocked with growing-stock trees, at least half o which are sawtimber and/or poletimber trees, an poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands. — Stands at least 16. percent stocked with growing-stock trees and wit saplings and/or seedlings comprising more than hal of this stocking.

Nonstocked areas. — Commercial forest land o which stocking of growing-stock trees is less than 16. percent.

Other Classifications

Site index. — An expression of forest site quality based on the height of a free-growing dominant o codominant tree of a representative species in the forest type at age 50.

Site class. — A classification of forest land in terms of inherent capacity to grow crops of industria wood expressed in cubic-foot growth per acre per year

Stand-age. — Age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Basal area. — The area in square feet of the cross section at breast height of a single tree. When the basal area of all the trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Forest Types

A classification of forest land based on the species forming a plurality of live-tree stocking. Major forest types in Minnesota are:

Jack pine. — Forests in which jack pine comprises a plurality of the stocking. (Common associates include eastern white pine, red pine, aspen, birch, and maple.)

Red pine. — Forests in which red pine comprises a plurality of the stocking. (Common associates include eastern white pine, jack pine, aspen, birch, and maple.)

White pine. — Forests in which eastern white pine mprises a plurality of the stocking. (Common asso-ates include red pine, jack pine, aspen, birch, and aple.)

Balsam fir. — Forests in which balsam fir and ite spruce comprise a plurality of the stocking with lsam fir the most common. (Common associates clude white spruce, aspen, maple, birch, northern ite-cedar, and tamarack.)

White spruce. — Forests in which white spruce d balsam fir comprise a plurality of the stocking th white spruce the most common. (Common asso-ates include balsam fir, aspen, maple, birch, north-n white-cedar, and tamarack.)

Black spruce. — Forests in which swamp conifers mprise a plurality of the stocking with black spruce e most common. (Common associates include tama-ck and northern white-cedar.)

Northern white-cedar. — Forests in which amp conifers comprise a plurality of the stocking th northern white-cedar the most common. (Com-on associates include tamarack and black spruce.)

Tamarack. — Forests in which swamp conifers mprise a plurality of the stocking with tamarack the ost common. (Common associates include black ruce and northern white-cedar.)

Oak. — Forests in which northern red oak, white k, or bur oak, singly or in combination, comprise a urality of the stocking. (Common associates include m, maple, and aspen.)

Elm-ash-cottonwood. — Forests in which low-nd elm, ash, cottonwood, and red maple, singly or in mbination, comprise a plurality of the stocking. ommon associates include basswood, and balsam plar.)

Maple-basswood. — Forests in which sugar ma-e, basswood, yellow birch, upland American elm, d red maple, singly or in combination, comprise a urality of the stocking. (Common associates include hite pine, and elm.)

Aspen. — Forests in which quaking aspen or gtooth aspen, singly or in combination, comprise a urality of the stocking. (Common associates include lsam poplar, balsam fir, and paper birch.)

Paper birch. — Forests in which paper birch mprises a plurality of the stocking. (Common asso-ates include maple, aspen, and balsam fir.)

Balsam poplar. — Forests in which balsam pop-r comprises a plurality of the stocking. (Common sociates include aspen, elm, and ash.)

Timber Volume

Volume of growing stock. — Net volume in cubic feet of growing-stock trees 5.0 inches d.b.h. and over, from a 1-foot stump to a minimum 4.0-inch top diameter outside bark of the central stem or to the point where the central stem breaks into limbs. Cubic feet can be converted to cords by multiplying by 79 cubic feet per solid wood cord.

Volume of sawtimber. — Net volume of the saw log portion of live sawtimber trees in board feet (International 1/4-inch rule) from stump to a minimum 7 inches top diameter outside bark (d.o.b.) for softwoods and a minimum 9 inches top d.o.b. for hardwoods.

Upper stem portion. — That part of the bole of sawtimber trees above the merchantable sawtimber top to a minimum top diameter of 4 inches outside bark or to the point where the central stem breaks into limbs.

Growth and Mortality

Net annual growth of growing stock. — The annual change in volume of sound wood in live growing-stock and sawtimber trees and the total volume of trees entering these classes through ingrowth, less volume losses resulting from natural causes.

Net annual growth of sawtimber. — The annual change in volume of live sawtimber trees and the total volume of trees reaching sawtimber size, less volume losses resulting from natural causes.

Mortality of growing stock. — The volume of sound wood in growing-stock trees that died during the year.

Mortality of sawtimber. — The net board-foot volume of sawtimber trees that died during the year.

Timber Removals

Timber removals from growing stock. — The volume of sound wood in growing-stock trees removed annually for forest products (including roundwood products and logging residues) and for other removals. Roundwood products are logs, bolts, or other round sections cut and used from trees. Logging residues are the unused portions of cut trees plus unused trees killed by logging. Other removals are growing-stock trees removed but not utilized for products or trees left standing but "removed" from

the commercial forest land classification by land use change — examples are removals from cultural operations such as timber stand improvement work, land clearing, and changes in land use.

Timber removals from sawtimber. — The net board-foot volume of live sawtimber trees removed for forest products annually (including roundwood products and logging residues) and for other removals.

Timber products output. — All timber products cut from roundwood, and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonfore land, noncommercial species, sapling-size trees, ar limbwood. Byproducts from primary manufacturir plants include slabs, edgings, trimmings, miscut sawdust, shavings, veneer cores and clippings, ar pulpmill screenings that are used as pulpwood chi or other products.

Plant byproducts. — Plant residues used f products such as mulch, pulp chips, and fuelwoo

Plant residues. — Wood and bark materials ge erated at manufacturing plants during production other products.

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Table 50.—Removals, net annual growth, and inventory of growing stock on commercial fore land, 1977, and high removals option pr jections to 2007.

SAMPLING ERRORS

Table 51.—Sampling errors for estimates small than the State totals of volume, n growth, removals, and area of commerci forest land.

Table 5.--Net volume of growing stock and sawtimber on commercial forest land by species group, Minnesota, 1/1962 and 1977

Species	Growing stock		Sawtimber	
	1/1962	1977	1/1962	1977
	Thousand cubic feet		2/Thousand board feet	
SOFTWOODS				
White pine	191,796	194,797	900,060	1,068,372
Red pine	325,301	434,556	1,530,249	1,952,896
Jack pine	733,320	593,704	1,402,842	1,566,444
Spruce	813,347	717,920	849,704	1,109,131
Balsam fir	765,270	893,608	791,442	1,338,249
Tamarack	302,558	250,589	281,500	346,508
Northern white-cedar	251,867	387,215	376,843	1,142,761
Other softwoods	--	4,618	--	6,228
Total	3,383,459	3,477,007	6,132,640	8,530,589
HARDWOODS				
White oak	278,877	358,272	817,696	1,076,044
Red oak	433,424	581,563	1,027,215	1,820,036
Yellow birch	13,904	10,611	63,839	39,926
Hard maple	134,865	189,024	455,532	489,619
Soft maple	94,429	131,845	232,890	281,999
Ash	426,107	538,086	758,002	993,952
Paper birch	841,822	1,273,982	491,034	1,234,388
Aspen	2,790,752	3,410,720	2,208,044	5,974,671
Basswood	239,667	402,424	719,073	1,116,835
Elm	341,740	431,437	1,257,911	1,607,307
Other hardwoods	464,614	649,026	710,952	1,441,832
Total	6,060,201	7,976,990	8,742,188	16,076,609
All species	9,443,660	11,453,997	14,874,828	24,607,198

1/Figures have been adjusted from those published after the 1962 survey to conform to 1977 volumes because of changes in survey definitions and procedures.

2/International 1/4-inch rule.

Table 6.--Cubic foot volume in all live trees on commercial forest land by species group and diameter class, Minnesota, 1977

(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS													
White pine	205,023	7,642	9,141	22,103	15,544	22,314	28,626	29,505	16,398	16,236	30,644	6,552	318
Red pine	437,926	25,560	50,642	56,305	56,198	60,473	64,893	58,162	30,079	25,080	10,207	327	--
Jack pine	619,448	100,012	173,666	157,527	113,540	46,410	22,888	3,727	1,112	396	170	--	--
White spruce	183,887	24,023	25,736	30,613	31,104	24,622	21,153	12,044	8,332	3,956	2,304	--	--
Black spruce	552,013	266,807	171,833	78,841	21,044	8,904	2,778	1,069	685	52	--	--	--
Balsam fir	937,200	323,402	296,481	186,037	86,750	29,843	9,451	4,672	322	242	--	--	--
Tamarack	277,608	107,291	88,212	47,286	24,004	7,410	2,402	812	96	--	95	--	--
Northern white-cedar	463,876	84,543	106,085	99,802	74,301	47,050	26,702	13,924	7,513	2,136	1,713	107	--
Other softwoods	5,945	2,051	1,534	846	657	361	201	63	158	74	--	--	--
Total	3,682,926	941,331	923,330	679,360	423,142	247,387	179,094	123,978	64,695	48,172	45,133	6,986	318
HARDWOODS													
Select white oak	414,782	44,857	58,800	67,455	65,416	52,418	44,138	26,149	19,917	12,956	18,498	3,788	390
Select red oak	628,225	51,581	94,520	108,368	97,333	85,856	64,822	46,732	29,555	20,466	23,471	5,286	235
Other red oak	13,844	453	702	1,074	1,232	1,743	2,453	1,876	1,406	1,185	1,653	67	--
Hickory	17,210	3,191	3,246	3,674	2,824	2,307	1,028	420	397	123	--	--	--
Yellow birch	18,196	1,335	1,710	1,704	3,227	2,803	1,791	1,874	893	947	1,855	57	--
Hard maple	263,723	50,307	42,078	46,499	33,412	34,086	23,707	16,377	8,428	3,638	4,831	295	65
Soft maple	171,993	47,787	37,694	22,744	16,254	11,814	9,513	6,730	4,119	2,663	5,690	4,100	2,885
Ash	585,894	135,853	145,970	127,276	77,422	48,013	28,294	10,222	5,767	2,667	3,542	574	294
Balsam poplar	598,970	88,420	141,475	141,920	110,400	63,090	32,721	13,196	4,533	1,344	1,662	172	37
Paper birch	1,416,500	362,655	446,212	320,088	166,257	70,803	31,720	10,298	6,306	1,477	684	--	--
Bigtooth aspen	201,225	20,348	48,333	54,754	37,974	21,471	10,378	5,299	1,771	853	44	--	--
Quaking aspen	3,782,905	540,038	934,303	974,591	709,965	360,902	160,098	65,698	24,249	8,332	4,704	25	--
Basswood	442,931	49,939	80,985	80,692	69,324	51,440	39,635	27,161	18,229	10,168	12,325	2,703	330
Elm	485,879	37,657	53,695	61,411	58,300	52,447	50,973	44,231	29,745	25,012	44,323	21,562	6,523
Select hardwoods	22,911	4,006	3,310	4,002	3,665	2,512	2,501	1,419	412	216	556	312	--
Other hardwoods	80,832	8,255	10,115	10,718	9,590	7,480	6,249	4,935	3,921	4,136	4,540	5,872	5,021
Noncommercial species	16,884	7,794	4,774	1,783	1,046	557	436	135	197	--	65	97	--
Total	9,162,904	1,454,476	2,107,922	2,028,753	1,463,641	869,742	510,457	282,752	159,845	96,183	128,443	44,910	15,780
All species	12,845,830	2,395,807	3,031,252	2,708,113	1,886,783	1,117,129	689,551	406,730	224,540	144,355	173,576	51,896	16,098

Table 7.--Net volume of timber on commercial forest land by class of timber and softwoods and hardwoods, Minnesota, 1977

(In thousand cubic feet)

Class of timber	All species	Softwoods	Hardwoods
GROWING-STOCK TREES			
Saw log trees			
Saw log portion	3,499,363	1,292,396	2,206,967
Upper stem portion	1,232,785	426,209	806,576
Subtotal	4,732,148	1,718,605	3,013,543
Poletimber	6,721,849	1,758,402	4,963,447
Total	11,453,997	3,477,007	7,976,990
CULL TREES			
Rough and rotten cull trees			
Sawtimber	473,416	72,602	400,814
Poletimber	733,960	106,257	627,703
Subtotal	1,207,376	178,859	1,028,517
Short-log cull trees			
Sawtimber	184,457	27,060	157,397
Poletimber	--	--	--
Subtotal	184,457	27,060	157,397
Total	1,391,833	205,919	1,185,914
SALVABLE DEAD TREES	107,031	47,856	59,175
All classes	12,952,861	3,730,782	9,222,079

County	Growing stock						Sawtimber					
	All species	Pine	Spruce-fir	Other softwoods	Aspen	Other hardwoods	All species	Pine	Spruce-fir	Other softwoods	Aspen	Other hardwoods
	Thousand cubic feet						Thousand board feet[1/]					
ASPEN-BIRCH												
Carlton	210,376	18,849	25,747	8,117	57,322	100,341	347,958	91,996	37,529	10,104	62,312	146,017
Cook	534,017	33,526	179,850	31,744	171,395	117,502	1,083,698	136,545	313,513	116,398	400,505	116,737
Koochiching	928,923	43,462	271,210	135,430	262,888	215,933	1,594,444	145,029	308,582	330,176	387,920	422,737
Lake	694,029	59,566	165,030	54,112	158,441	256,880	1,466,852	253,984	246,627	199,397	366,035	400,809
St. Louis	2,154,730	295,927	474,006	92,359	736,692	555,746	3,831,644	1,074,438	677,313	199,597	1,187,494	692,802
Total	4,522,075	451,330	1,115,843	321,762	1,386,738	1,246,402	8,324,596	1,701,992	1,583,564	855,672	2,404,266	1,779,102
NORTHERN PINE												
Aitkin	487,614	8,372	36,300	34,082	123,423	285,437	1,039,872	38,096	63,867	60,083	251,714	626,112
Becker	305,068	33,278	14,819	7,191	107,449	142,331	620,361	108,439	35,053	15,581	153,771	307,517
Beltrami	683,735	105,002	67,283	71,526	213,220	226,704	1,407,730	402,218	102,768	98,078	387,647	417,019
Cass	854,270	186,144	64,160	34,964	274,528	294,474	2,027,912	782,239	128,207	85,317	564,796	467,353
Clearwater	266,797	21,628	15,774	11,151	100,995	117,249	521,323	98,311	27,623	28,683	148,506	218,200
Crow Wing	327,167	58,342	5,903	5,501	109,000	148,421	592,708	163,761	7,621	10,789	195,735	214,802
Hubbard	344,524	89,758	13,271	5,252	147,637	88,606	608,538	270,562	31,813	12,934	199,544	93,685
Itasca	1,297,155	157,615	225,932	77,632	426,676	409,300	2,987,983	703,993	395,196	202,778	942,958	743,058
Lake of the Woods	192,801	27,116	29,604	28,461	58,679	48,941	334,578	66,212	32,034	44,231	98,880	93,221
Mahnomen	91,371	1,495	589	1,067	29,118	59,102	168,247	2,764	1,730	3,829	47,271	112,653
Roseau	99,416	16,466	9,369	13,351	29,068	31,162	183,368	53,389	15,509	22,931	43,336	48,203
Wadena	72,976	28,992	881	1,183	22,466	19,454	128,130	62,728	2,838	--	22,387	40,177
Total	5,022,894	734,208	483,885	291,361	1,642,259	1,871,181	10,620,750	2,752,712	844,259	585,234	3,056,545	3,382,000
CENTRAL HARDWOOD												
Anoka	28,414	821	52	747	2,202	24,592	105,665	2,481	97	1,565	3,605	97,917
Benton	22,075	1,271	61	145	2,758	17,840	73,720	2,356	140	382	4,949	65,893
Carver	9,221	111	9	154	487	8,460	38,303	548	19	326	846	36,564
Chisago	39,317	1,511	238	1,364	3,960	32,244	136,656	3,134	411	2,800	6,908	123,403
Dakota	13,381	285	65	606	1,367	11,058	45,496	1,125	119	1,060	2,465	40,727
Douglas	12,281	235	65	321	2,208	9,452	35,423	990	168	762	3,094	30,409
Fillmore	54,832	1,219	19	354	5,949	47,291	183,563	5,213	73	696	8,751	168,830
Goodhue	52,365	805	40	397	4,440	46,683	182,049	2,902	94	723	7,397	170,933
Hennepin	6,455	76	12	168	394	5,805	26,870	346	22	335	768	25,399
Houston	106,619	801	32	273	6,244	99,269	392,741	3,560	111	493	10,500	378,077
Isanti	32,797	2,251	283	1,713	3,942	24,608	97,605	3,595	410	3,703	5,974	83,923
Kanabec	101,060	1,857	678	2,204	26,220	70,101	255,196	8,055	1,074	4,898	40,544	200,625
Le Sueur	9,030	89	20	270	520	8,131	36,716	365	36	537	978	34,800
Mille Lacs	95,532	1,542	674	2,179	22,976	68,161	247,242	6,523	1,080	4,664	37,573	197,402
Morrison	115,167	3,027	271	2,372	14,803	94,694	366,219	10,483	496	5,165	22,511	327,564
Olmsted	26,266	596	8	221	2,572	22,869	91,348	2,685	30	462	3,781	84,390
Otter Tail	140,234	3,191	1,217	2,974	35,703	97,149	345,069	12,702	2,084	5,992	56,778	267,513
Pine	299,170	11,035	6,434	7,574	107,800	166,327	588,231	38,601	9,162	10,393	162,088	367,987
Ramsey	--	--	--	--	--	--	--	--	--	--	--	--
Rice	10,778	83	33	148	820	9,694	44,855	391	100	332	1,448	42,584
Scott	12,340	123	16	234	589	11,378	51,873	581	39	491	1,065	49,697
Sherburne	48,087	1,586	268	543	3,543	42,147	167,266	3,911	265	454	5,591	157,045
Stearns	49,181	723	77	349	4,286	43,746	178,922	3,413	177	706	8,040	166,586
Todd	77,260	1,154	421	1,416	14,058	60,211	222,937	4,840	1,111	3,155	22,988	190,843
Wabasha	48,661	900	31	506	5,049	42,175	162,174	3,807	87	1,012	7,774	149,494
Washington	8,726	96	40	336	779	7,475	34,426	394	43	557	1,374	32,058
Winona	100,794	908	24	231	6,915	92,716	360,560	3,885	85	394	11,370	344,826
Wright	26,773	439	85	362	3,913	21,974	82,629	1,855	230	828	6,222	73,494
Total	1,546,816	36,735	11,173	28,161	284,497	1,186,250	4,553,754	128,741	17,763	52,885	445,382	3,908,983

(Table 8 continued on next page)

(Table 8 continued)

PRAIRIE

County	Growing stock						Sawtimber					
	All species	Pine	Spruce-fir	Other softwoods	Aspen	Other hardwoods	All species	Pine	Spruce-fir	Other softwoods	Aspen	Other hardwoods
	Thousand cubic feet						Thousand board feet[1]					
Big Stone	1,574	--	--	2	282	1,290	5,317	--	--	5	225	5,087
Blue Earth	19,767	--	2	93	983	18,689	88,482	--	8	135	844	87,495
Brown	8,526	--	--	66	469	7,991	37,925	--	--	96	465	37,364
Chippewa	2,438	--	--	5	487	1,946	7,575	--	--	10	415	7,150
Clay	7,296	--	12	8	1,435	5,841	23,101	--	68	16	835	22,182
Cottonwood	2,153	--	--	--	382	1,771	7,863	--	--	--	363	7,500
Dodge	6,136	--	--	69	162	5,905	28,198	--	--	100	136	27,962
Faribault	5,608	--	--	6	446	5,156	24,300	--	--	9	430	23,861
Freeborn	4,339	--	2	43	221	4,073	19,191	--	8	64	134	18,985
Grant	2,715	--	--	1	461	2,253	9,536	--	--	2	249	9,285
Jackson	1,958	--	--	3	207	1,748	7,902	--	--	4	180	7,718
Kandiyohi	7,947	--	3	57	709	7,178	33,130	--	17	85	592	32,436
Kittson	32,021	296	114	106	16,958	14,547	44,047	1,614	137	194	10,077	32,025
Lac qui Parle	3,580	--	1	2	480	3,097	14,047	--	9	3	468	13,567
Lincoln	1,867	--	--	9	230	1,628	7,511	--	--	13	203	7,295
Lyon	3,485	--	--	10	359	3,116	14,137	--	--	15	325	13,797
McLeod	5,839	--	--	1	310	5,528	26,304	--	--	1	210	26,093
Marshall	63,118	371	283	207	29,098	33,159	111,282	2,021	687	293	18,437	89,844
Martin	3,085	--	--	1	521	2,563	11,394	--	--	1	468	10,925
Meeker	9,998	--	--	31	208	9,759	47,438	--	--	44	173	47,221
Mower	4,959	--	--	46	204	4,709	22,417	--	--	66	175	22,176
Murray	790	--	--	--	72	718	3,197	--	--	1	61	3,135
Nicollet	11,490	--	1	20	601	10,868	52,093	--	8	28	575	51,482
Nobles	523	--	--	--	135	388	1,553	--	--	1	115	1,437
Norman	15,448	11	19	11	5,353	10,054	39,652	61	86	19	4,235	35,251
Pennington	20,227	37	41	20	8,665	11,464	43,803	199	165	35	6,607	36,797
Pipestone	382	--	--	3	69	310	1,338	--	--	4	59	1,275
Polk	48,740	38	99	69	14,344	34,190	144,142	208	452	107	10,790	132,585
Pope	4,762	2	10	31	1,120	3,599	14,027	8	6	36	905	13,072
Red Lake	17,932	29	29	34	8,048	9,792	36,804	156	110	55	6,257	30,226
Redwood	4,783	--	3	31	668	4,081	17,862	--	17	45	547	17,253
Renville	6,586	--	6	37	584	5,959	27,371	--	8	48	543	26,772
Rock	319	--	--	1	49	269	1,054	--	--	1	42	1,011
Sibley	10,382	--	--	51	562	9,769	46,617	--	--	73	437	46,107
Steele	4,560	--	2	24	283	4,251	20,074	--	8	35	202	19,829
Stevens	741	--	--	--	184	557	2,389	--	--	1	120	2,268
Swift	3,494	--	--	7	639	2,848	12,142	--	--	10	493	11,639
Traverse	509	--	--	2	107	400	1,477	--	--	3	91	1,383
Waseca	4,007	--	--	10	166	3,831	18,469	--	--	15	156	18,298
Watonwan	897	--	--	--	19	878	4,240	--	--	--	52	4,188
Wilkin	225	--	--	1	65	159	537	--	--	1	32	504
Yellow Medicine	7,006	--	--	20	881	6,105	28,157	--	--	30	754	27,373
Total	362,212	784	627	1,138	97,226	262,437	1,108,095	4,267	1,794	1,704	68,477	1,031,853
All units	11,453,997	1,223,057	1,611,528	642,422	3,410,720	4,566,270	24,607,195	4,587,712	2,447,380	1,495,495	5,974,670	10,101,938

[1] International 1/4-inch rule.

Table 9.--Net volume of growing stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species, Minnesota, 1977

Species	Total all live	Growing stock	Short-log	Rough and rotten	Sawtimber
	Thousand cubic feet				Thousand board feet 1/
SOFTWOODS					
White pine	205,023	194,797	1,729	8,497	1,068,372
Red pine	437,926	434,556	785	2,585	1,952,896
Jack pine	619,449	593,704	4,109	21,636	1,566,444
Scotch pine	1,165	1,036	--	129	1,666
White spruce	183,887	180,969	264	2,654	648,730
Black spruce	552,013	536,951	1,208	13,854	460,401
Balsam fir	937,200	893,608	4,229	39,363	1,338,249
Tamarack	277,608	250,589	2,462	24,557	346,508
Northern white-cedar	463,876	387,215	11,883	64,778	1,142,761
Eastern redcedar	4,779	3,582	391	806	4,562
Total	3,682,926	3,477,007	27,060	178,859	8,530,589
HARDWOODS					
White oak	65,467	54,086	3,761	7,620	204,223
Bur oak	349,191	304,186	12,310	32,695	871,821
Swamp white oak	124	--	--	124	--
Northern red oak	628,225	568,939	13,346	45,940	1,763,622
Black oak	2,734	2,372	--	362	10,525
Northern pin oak	11,110	10,252	385	473	45,889
Bitternut hickory	5,294	5,211	--	83	6,798
Shagbark hickory	11,916	11,207	200	509	25,585
Yellow birch	18,196	10,611	2,057	5,528	39,926
Sugar maple	262,890	188,534	10,015	64,341	487,955
Black maple	833	490	--	343	1,664
Red maple	134,415	100,171	1,519	32,725	110,402
Silver maple	37,578	31,674	1,869	4,035	171,596
White ash	2,809	2,349	--	460	10,239
Black ash	485,614	449,732	4,003	31,879	727,731
Green ash	97,471	86,005	1,364	10,102	255,982
Balsam poplar	598,970	548,624	5,239	45,107	1,101,406
Paper birch	1,416,500	1,273,982	11,929	130,589	1,234,388
Bigtooth aspen	201,225	174,315	3,398	23,512	303,391
Quaking aspen	3,782,905	3,236,405	60,256	486,244	5,671,280
Basswood	442,931	402,424	7,295	33,212	1,116,835
American elm	449,804	398,468	14,725	36,611	1,461,780
Slippery elm	31,155	28,681	465	2,009	129,165
Rock elm	4,920	4,288	104	528	16,362
Butternut	7,659	5,575	354	1,730	13,357
Black walnut	5,071	4,686	124	261	13,690
Black cherry	10,181	8,055	11	2,115	13,145
Boxelder	33,332	22,203	1,133	9,996	53,725
River birch	504	300	73	131	289
Hackberry	4,142	3,585	242	315	14,923
Eastern cottonwood	23,205	21,589	887	729	117,565
Black willow	19,076	17,561	257	1,258	80,118
Kentucky coffeetree	573	430	76	67	1,231
Noncommercial	16,884	--	--	16,884	--
Total	9,162,904	7,976,990	157,397	1,028,517	16,076,608
All species	12,845,830	11,453,997	184,457	1,207,376	24,607,197

1/ International 1/4-inch rule.

Table 10.--Net volume of growing stock on commercial forest land by species group and Forest Survey Unit, Minnesota, 1977

(In thousand cubic feet)

Species	All units	Aspen-Birch	Northern Pine	Central Hardwood	Prairie
SOFTWOODS					
White pine	194,797	91,561	90,495	12,741	--
Red pine	434,556	147,197	273,024	13,843	492
Jack pine	593,704	212,572	370,689	10,151	292
White spruce	180,969	136,485	42,389	1,705	390
Black spruce	536,951	419,971	113,362	3,555	63
Balsam fir	893,608	559,387	328,134	5,913	174
Tamarack	250,589	75,063	150,313	24,900	313
Northern white-cedar	387,215	246,561	140,654	--	--
Other softwoods	4,618	138	394	3,261	825
Total	3,477,007	1,888,935	1,509,454	76,069	2,549
HARDWOODS					
Select white oak	358,272	5,277	119,986	172,960	60,049
Select red oak	568,939	9,347	217,524	326,516	15,552
Other red oak	12,624	--	1,015	11,087	522
Hickory	16,418	--	520	15,522	376
Yellow birch	10,611	6,861	3,552	198	--
Hard maple	189,024	43,352	83,680	54,508	7,484
Soft maple	131,845	38,495	49,757	40,258	3,335
Ash	538,086	196,644	241,200	76,509	23,733
Balsam poplar	548,624	244,477	265,529	12,839	25,779
Paper birch	1,273,982	620,775	538,764	111,395	3,048
Bigtooth aspen	174,315	21,001	123,016	30,271	27
Quaking aspen	3,236,405	1,365,737	1,519,243	254,226	97,199
Basswood	402,424	35,262	203,813	133,839	29,510
Elm	431,437	45,431	141,808	185,338	58,860
Select hardwoods	18,316	53	2,005	14,303	1,955
Other hardwoods	65,668	428	2,028	30,978	32,234
Noncommercial species	--	--	--	--	--
Total	7,976,990	2,633,140	3,513,440	1,470,747	359,663
All species	11,453,997	4,522,075	5,022,894	1,546,816	362,212

Table 11.--Net volume of sawtimber on commercial forest land by species group and Forest Survey Unit, Minnesota, 1977

(In thousand board feet)[1/]

Species	All units	Aspen-Birch	Northern Pine	Central Hardwood	Prairie
SOFTWOODS:					
White pine	1,068,372	515,487	489,804	63,081	--
Red pine	1,952,896	596,918	1,310,295	42,516	3,167
Jack pine	1,566,444	589,587	952,613	23,144	1,100
White spruce	648,730	471,316	168,448	7,172	1,794
Black spruce	460,401	371,239	87,515	1,647	--
Balsam fir	1,338,249	741,009	588,296	8,944	--
Tamarack	346,508	86,831	210,950	48,280	447
Northern white-cedar	1,142,761	768,841	373,920	--	--
Other softwoods	6,228	--	364	4,605	1,259
Total	8,530,589	4,141,228	4,182,205	199,389	7,767
HARDWOODS:					
Select white oak	1,076,044	13,774	264,498	570,892	226,880
Select red oak	1,763,622	23,285	439,583	1,237,647	63,107
Other red oak	56,414	--	1,141	52,870	2,403
Hickory	32,383	--	444	31,088	851
Yellow birch	39,926	27,091	11,866	969	--
Hard maple	489,619	56,909	204,393	198,945	29,372
Soft maple	281,998	30,931	75,450	158,376	17,241
Ash	993,952	312,399	352,993	227,791	100,769
Balsam poplar	1,101,406	481,135	572,553	18,664	29,054
Paper birch	1,234,388	591,221	570,799	69,492	2,876
Bigtooth aspen	303,391	32,683	213,453	57,255	--
Quaking aspen	5,671,280	2,371,583	2,843,092	388,128	68,477
Basswood	1,116,835	64,530	413,860	489,971	148,474
Elm	1,607,307	176,959	468,485	691,004	270,859
Select hardwoods	40,192	--	2,223	32,630	5,339
Other hardwoods	267,851	868	3,712	128,643	134,628
Noncommercial species	--	--	--	--	--
Total	16,076,608	4,183,368	6,438,545	4,354,365	1,100,330
All species	24,607,197	8,324,596	10,620,750	4,553,754	1,108,097

[1/]International 1/4-inch rule.

Table 12.--Net volume of growing stock on commercial forest land by species group and diameter class, Minnesota, 1977

(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS													
White pine	194,797	6,149	7,815	20,429	14,865	21,769	26,433	29,044	16,165	15,782	29,836	6,192	318
Red pine	434,556	24,844	49,880	55,803	55,778	60,043	64,893	57,934	29,903	25,005	10,158	315	--
Jack pine	593,704	95,316	166,977	151,777	109,695	43,944	21,196	3,499	734	396	170	--	--
White spruce	180,969	23,613	24,773	29,975	30,605	24,510	21,072	11,881	8,281	3,955	2,304	--	--
Black spruce	536,951	258,093	168,191	76,734	20,653	8,862	2,612	1,069	685	52	--	--	--
Balsam fir	893,608	305,998	285,790	177,026	83,296	28,282	8,862	3,789	323	242	--	--	--
Tamarack	250,589	95,661	80,677	42,818	21,901	6,692	2,150	595	--	--	95	--	--
Northern white-cedar	387,215	70,403	90,957	82,057	60,214	39,889	22,618	11,559	6,307	1,658	1,462	91	--
Other softwoods	4,618	1,751	1,515	559	591	132	70	--	--	--	--	--	--
Total	3,477,007	881,828	876,575	637,178	397,598	234,123	169,906	119,370	62,398	47,090	44,025	6,598	318
HARDWOODS													
Select white oak	358,272	40,856	53,466	61,660	56,973	46,495	36,325	21,257	16,177	9,728	12,586	2,359	390
Select red oak	568,939	46,756	88,659	101,481	88,002	77,602	57,935	41,582	25,635	17,550	19,538	4,012	187
Other red oak	12,624	404	676	1,005	1,189	1,453	2,453	1,737	1,185	826	1,628	68	--
Hickory	16,418	3,090	3,191	3,592	2,713	2,077	918	384	330	123		--	--
Yellow birch	10,611	874	951	732	2,119	1,623	1,187	1,262	774	450	639	--	--
Hard maple	189,024	41,911	32,145	30,538	23,155	23,212	16,150	11,876	4,794	1,952	3,166	60	65
Soft maple	131,845	40,366	27,996	16,470	12,622	9,181	6,509	4,818	2,845	1,920	4,449	2,694	1,975
Ash	538,086	125,386	135,624	116,819	70,105	44,109	25,857	9,037	5,336	2,275	2,806	438	294
Balsam poplar	548,624	79,004	129,510	131,819	103,339	57,647	29,877	11,009	3,930	863	1,454	172	--
Paper birch	1,273,982	325,598	406,838	291,766	147,840	61,949	25,675	7,906	5,092	901	417	--	--
Bigtooth aspen	174,315	17,677	43,195	49,705	32,880	17,052	8,190	4,056	1,009	551	--	--	--
Quaking aspen	3,236,405	470,750	820,817	854,070	607,753	294,792	121,463	43,802	14,986	4,900	3,072	--	--
Basswood	402,424	44,906	75,355	74,498	62,992	46,707	35,977	24,444	16,578	8,772	9,931	2,078	186
Elm	431,437	35,234	49,769	54,498	52,357	46,789	46,464	40,376	26,398	21,716	37,658	15,916	4,262
Select hardwoods	18,316	2,936	2,699	3,480	3,079	1,954	2,215	1,213	287	169	284	--	--
Other hardwoods	65,668	6,856	8,450	9,368	7,664	5,799	4,916	3,985	3,212	3,080	3,215	4,883	4,240
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	7,976,990	1,282,604	1,879,341	1,801,501	1,274,782	738,441	422,111	228,744	128,568	75,776	100,843	32,680	11,599
All species	11,453,997	2,164,432	2,755,916	2,438,679	1,672,380	972,564	592,017	348,114	190,966	122,866	144,868	39,278	11,917

Table 13.--Net volume of sawtimber on commercial forest land by species group and diameter class, Minnesota, 1977

(In thousand board feet)[1/]

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS											
White pine	1,068,372	121,360	93,477	130,950	153,745	167,250	94,677	91,464	175,759	37,359	2,331
Red pine	1,952,896	261,711	288,634	312,921	346,863	329,144	178,336	160,738	71,378	3,171	--
Jack pine	1,566,444	725,404	506,640	205,290	106,429	16,547	3,364	1,991	779	--	--
White spruce	648,730	126,383	140,116	124,198	110,760	64,162	47,201	22,178	13,732	--	--
Black spruce	460,401	307,934	89,418	40,786	12,564	5,568	3,539	592	--	--	--
Balsam fir	1,338,249	784,954	369,426	124,454	39,333	17,287	1,430	1,365	--	--	--
Tamarack	346,508	198,533	102,284	31,041	10,570	3,160	--	--	920	--	--
Northern white-cedar	1,142,761	421,477	301,268	197,974	110,762	57,344	34,045	9,943	9,091	857	--
Other softwoods	6,228	2,927	2,549	477	275	--	--	--	--	--	--
Total	8,530,589	2,950,683	1,893,812	1,168,091	891,301	660,462	362,592	288,271	271,659	41,387	2,331
HARDWOODS											
Select white oak	1,076,044	--	301,831	247,911	194,992	111,213	86,100	52,070	67,403	12,488	2,036
Select red oak	1,763,622	--	455,970	412,745	311,706	223,639	137,318	94,558	105,549	21,036	1,101
Other red oak	56,414	--	6,441	7,692	12,915	9,459	6,387	4,386	8,729	405	--
Hickory	32,383	--	13,211	11,226	4,312	1,637	1,473	524	--	--	--
Yellow birch	39,926	--	10,374	8,443	6,651	6,202	3,717	1,958	2,581	--	--
Hard maple	489,619	--	134,596	132,811	92,012	70,081	29,254	11,626	18,315	470	454
Soft maple	281,998	--	73,576	59,117	40,986	30,231	18,306	11,982	25,173	13,747	8,880
Ash	993,952	--	440,293	271,984	152,502	58,515	33,079	15,803	17,839	2,432	1,505
Balsam poplar	1,101,406	--	534,789	307,661	161,412	60,691	21,563	4,900	9,653	737	--
Paper birch	1,234,388	--	742,689	305,074	121,115	38,016	21,772	4,017	1,705	--	--
Bigtooth aspen	303,391	--	154,814	81,851	39,560	19,260	4,866	3,040	--	--	--
Quaking aspen	5,671,280	--	3,179,633	1,518,668	631,756	221,601	77,557	25,103	16,962	--	--
Basswood	1,116,835	--	325,520	249,097	197,069	136,234	92,959	48,423	55,294	11,341	898
Elm	1,607,307	--	297,358	261,745	254,321	217,866	144,202	116,545	206,103	85,529	23,638
Select hardwoods	40,192	--	11,670	7,999	9,490	6,600	1,679	1,182	1,572	--	--
Other hardwoods	267,851	--	59,151	41,930	35,418	27,639	20,634	18,969	18,708	25,120	20,282
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--
Total	16,076,608	--	6,741,916	3,925,954	2,266,217	1,238,884	700,866	415,086	555,586	173,305	58,794
All species	24,607,197	2,950,683	8,635,728	5,094,045	3,157,518	1,899,346	1,063,458	703,357	827,245	214,692	61,125

[1/] International 1/4-inch rule.

Table 14.--Net volume of growing stock on commercial forest land by species group and forest type, Minnesota, 1977

(In thousand cubic feet)

Species	All types	Forest type						
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
SOFTWOODS								
White pine	194,797	2,788	45,377	52,529	11,887	1,009	2,787	2,631
Red pine	434,556	38,735	251,343	16,619	12,406	1,119	1,839	3,477
Jack pine	593,704	435,520	16,837	5,630	6,558	2,506	15,145	1,862
White spruce	180,969	2,337	4,222	6,694	34,120	20,094	8,614	2,363
Black spruce	536,951	16,129	1,403	803	54,748	1,244	342,917	38,975
Balsam fir	893,608	5,764	14,921	3,850	299,047	4,765	29,742	33,255
Tamarack	250,589	125	281	--	11,015	624	37,677	11,725
Northern white-cedar	387,215	--	312	211	42,370	1,760	10,264	235,540
Other softwoods	4,618	--	589	--	--	--	184	--
Total	3,477,007	501,398	335,285	86,336	472,151	33,121	449,169	329,828
HARDWOODS								
Select white oak	358,272	854	226	623	613	29	--	--
Select red oak	568,939	2,628	1,037	571	152	--	197	--
Other red oak	12,624	--	--	--	--	--	--	--
Hickory	16,418	--	--	--	--	--	--	--
Yellow birch	10,611	--	--	--	308	--	--	715
Hard maple	189,024	--	--	221	607	--	--	--
Soft maple	131,845	1,334	56	870	2,426	--	286	57
Ash	538,086	64	129	345	8,550	--	2,115	9,017
Balsam poplar	548,624	579	559	46	19,671	722	1,110	6,635
Paper birch	1,273,982	11,385	24,693	4,421	93,342	8,572	7,902	24,318
Bigtooth aspen	174,315	3,248	2,887	37	789	--	311	516
Quaking aspen	3,236,405	38,439	14,328	10,143	77,556	7,516	32,326	7,309
Basswood	402,424	63	--	465	1,448	--	--	--
Elm	431,437	124	43	--	1,530	--	79	172
Select hardwoods	18,316	--	--	--	--	--	--	--
Other hardwoods	65,668	225	118	--	--	--	--	--
Noncommercial species	--	--	--	--	--	--	--	--
Total	7,976,990	58,943	44,076	17,742	206,992	16,839	44,326	48,739
All species	11,453,997	560,341	379,361	104,078	679,143	49,960	493,495	378,567

(Table 14 continued on next page)

(Table 14 continued)

Species	Forest type							
	Tamarack	Oak hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
SOFTWOODS								
White pine	1,248	2,422	1,583	12,990	43,050	14,053	443	--
Red pine	514	6,075	322	766	75,167	25,865	309	--
Jack pine	1,047	6,565	442	1,700	87,605	9,032	1,162	2,093
White spruce	488	554	5,123	7,715	65,257	17,996	5,392	--
Black spruce	21,379	86	2,265	975	48,382	4,671	2,537	437
Balsam fir	3,478	577	35,475	42,678	292,578	84,111	39,590	3,777
Tamarack	161,129	214	3,179	2,566	11,872	4,983	4,371	828
Northern white-cedar	4,706	--	29,393	12,048	31,292	12,495	6,419	405
Other softwoods	--	2,275	89	1,019	45	296	121	--
Total	193,989	18,768	77,871	82,457	655,248	173,502	60,344	7,540
HARDWOODS								
Select white oak	--	186,573	7,989	64,565	85,978	8,692	1,924	206
Select red oak	197	345,887	1,118	66,373	120,485	29,402	892	--
Other red oak	--	9,034	317	1,774	1,296	69	134	--
Hickory	--	12,728	--	2,863	--	827	--	--
Yellow birch	--	--	1,814	6,110	250	1,185	229	--
Hard maple	--	5,497	1,901	147,695	23,019	8,550	1,430	104
Soft maple	253	5,064	28,823	34,196	40,287	17,832	361	--
Ash	424	9,393	267,189	95,747	98,957	24,632	20,901	623
Balsam poplar	2,308	1,949	21,942	16,858	231,042	23,691	221,373	139
Paper birch	3,135	44,595	28,129	81,071	448,945	467,891	24,200	1,383
Bigtooth aspen	--	11,001	1,233	9,597	135,755	8,588	353	--
Quaking aspen	2,604	53,146	22,274	85,594	2,697,885	124,144	59,467	3,674
Basswood	--	30,356	11,609	271,204	69,857	15,372	2,050	--
Elm	910	36,307	70,521	225,013	67,648	14,916	13,654	520
Select hardwoods	--	10,080	607	5,204	1,911	389	67	58
Other hardwoods	--	3,908	40,945	16,554	3,362	--	213	343
Noncommercial species	--	--	--	--	--	--		
Total	9,831	765,518	506,411	1,130,418	4,026,677	746,180	347,248	7,050
All species	203,820	784,286	584,282	1,212,875	4,681,925	919,682	407,592	14,590

Table 15.--Net volume of sawtimber on commercial forest land by species group and forest type, Minnesota, 1977

(In thousand board feet)[1/]

Species	All types	Forest type: Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
SOFTWOODS								
White pine	1,068,372	10,856	237,978	289,021	72,837	6,649	16,097	16,202
Red pine	1,952,896	135,809	1,093,109	88,319	64,394	4,588	9,963	18,696
Jack pine	1,566,444	1,051,843	45,843	28,580	25,931	10,876	43,528	6,303
White spruce	648,730	4,381	13,789	29,458	125,019	65,686	26,213	8,914
Black spruce	460,401	11,469	998	1,192	79,000	1,404	180,844	64,052
Balsam fir	1,338,249	3,897	46,705	7,691	394,770	5,506	25,026	29,443
Tamarack	346,508	687	354	--	25,465	2,388	40,026	14,828
Northern white-cedar	1,142,761	--	1,101	428	132,944	7,411	17,620	619,635
Other softwoods	6,228	--	--	--	--	--	--	--
Total	8,530,589	1,218,942	1,439,877	444,689	920,360	104,508	359,317	778,073
HARDWOODS								
Select white oak	1,076,044	393	--	552	1,904	--	--	--
Select red oak	1,763,622	1,531	2,005	2,376	438	--	--	--
Other red oak	56,414	--	--	--	--	--	--	--
Hickory	32,383	--	--	--	--	--	--	--
Yellow birch	39,926	--	--	--	646	--	--	2,236
Hard maple	489,619	--	--	1,344	--	--	--	--
Soft maple	281,998	--	--	346	7,623	--	684	--
Ash	993,952	--	--	368	12,125	--	6,719	16,218
Balsam poplar	1,101,406	975	--	--	30,680	750	1,048	16,036
Paper birch	1,234,388	3,909	36,621	3,857	141,043	11,322	4,826	42,718
Bigtooth aspen	303,391	1,181	318	--	2,475	--	393	1,176
Quaking aspen	5,671,280	61,514	19,307	37,026	123,947	16,488	31,878	15,719
Basswood	1,116,835	--	--	1,296	4,582	--	--	--
Elm	1,607,307	424	--	--	4,617	--	--	762
Select hardwoods	40,192	--	--	--	--	--	--	--
Other hardwoods	267,851	--	--	--	--	--	--	--
Noncommercial species	--	--	--	--	--	--	--	--
Total	16,076,608	69,927	58,251	47,165	330,080	28,560	45,548	94,865
All species	24,607,197	1,288,869	1,498,128	491,854	1,250,440	133,068	404,865	872,938

(Table 15 continued on next page)

[1/]International 1/4-inch rule.

(Table 15 continued)

Species	Forest type							
	Tamarack	Oak hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
SOFTWOODS								
White pine	7,454	13,968	10,261	73,792	235,419	75,224	2,614	--
Red pine	2,293	27,070	1,128	4,353	365,963	135,609	1,602	--
Jack pine	2,655	18,743	1,214	7,218	284,213	32,953	896	5,648
White spruce	1,028	2,357	19,458	34,788	217,387	79,613	20,639	--
Black spruce	12,464	353	4,429	1,720	84,154	10,270	7,073	979
Balsam fir	4,453	493	59,563	94,096	459,104	125,661	71,838	10,003
Tamarack	177,555	1,101	7,247	6,685	36,068	14,748	17,602	1,754
Northern white-cedar	11,911	--	108,288	52,133	118,607	48,256	22,913	1,514
Other softwoods	--	4,039	364	1,825	--	--	--	--
Total	219,813	68,124	211,952	276,610	1,800,915	522,334	145,177	19,898
HARDWOODS								
Select white oak	--	601,375	29,402	237,231	181,871	17,761	4,879	676
Select red oak	1,082	1,165,499	926	247,767	273,100	65,337	3,561	--
Other red oak	--	42,719	1,718	9,021	2,231	--	725	--
Hickory	--	23,625	--	5,456	--	3,302	--	--
Yellow birch	--	--	7,306	24,162	463	4,218	895	--
Hard maple	--	14,787	4,913	435,094	26,390	6,490	601	--
Soft maple	--	9,080	148,521	79,370	31,582	4,792	--	--
Ash	--	20,987	467,143	278,329	127,516	31,683	30,240	2,624
Balsam poplar	4,939	4,350	64,585	49,547	449,184	52,074	427,238	--
Paper birch	2,416	29,524	44,761	145,752	358,611	370,387	37,849	792
Bigtooth aspen	--	29,064	2,877	29,072	219,687	17,148	--	--
Quaking aspen	3,989	94,318	53,728	198,888	4,572,282	307,130	128,498	6,568
Basswood	--	78,306	40,612	860,089	98,727	29,965	3,258	--
Elm	811	122,620	270,664	936,185	182,843	39,943	46,278	2,160
Select hardwoods	--	21,447	226	15,359	2,483	677	--	--
Other hardwoods	--	12,123	177,158	68,153	8,492	--	--	1,925
Noncommercial species	--	--	--	--	--	--	--	--
Total	13,237	2,269,824	1,314,540	3,619,475	6,535,462	950,907	684,022	14,745
All species	233,050	2,337,948	1,526,492	3,896,085	8,336,377	1,473,241	829,199	34,643

Table 16.--Net volume of growing stock on commercial forest land by species group and ownership class, Minnesota, 1977

(In thousand cubic feet)

Species	All owners	Ownership class											
		National Forest	Bureau of Land Mgmt.	Indian	Misc. Federal	State	County & municipal	Forest Industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
SOFTWOODS													
White pine	194,797	76,561	448	12,675	1,408	15,003	23,886	10,787	30,214	5,395	17,446	--	974
Red pine	434,556	185,006	2,503	18,320	958	47,939	62,798	20,305	48,232	6,782	41,713	--	--
Jack pine	593,704	157,912	9,613	8,978	4,146	101,261	89,280	46,130	96,742	13,088	66,288	266	--
White spruce	180,969	49,247	1,360	5,073	1,675	30,138	32,968	16,341	18,331	5,793	19,919	124	--
Black spruce	536,951	106,720	3,591	17,903	3,708	221,824	67,696	42,303	31,201	15,852	25,800	353	--
Balsam fir	893,608	218,902	913	22,874	5,106	156,371	201,918	77,640	94,053	35,962	79,551	--	318
Tamarack	250,589	13,094	571	17,729	1,483	108,065	36,308	6,387	42,774	7,531	16,647	--	--
Northern white-cedar	387,215	63,624	3,815	33,043	1,667	136,637	51,746	45,148	19,439	7,474	24,622	--	--
Other softwoods	4,618	--	--	--	--	983	138	--	2,568	604	325	--	--
Total	3,477,007	871,066	22,814	136,595	20,151	818,221	566,738	265,041	383,554	98,481	292,311	743	1,292
HARDWOODS													
Select white oak	358,272	8,109	84	7,563	1,508	19,393	20,508	1,391	241,026	7,190	50,382	--	1,118
Select red oak	568,939	10,862	--	5,462	4,080	61,287	53,170	6,634	293,332	17,907	114,562	--	1,643
Other red oak	12,624	--	--	--	380	1,201	58	--	10,519	--	466	--	--
Hickory	16,418	--	--	191	327	246	300	--	14,067	--	1,287	--	--
Yellow birch	10,611	461	--	--	--	978	5,556	691	490	988	1,447	--	--
Hard maple	189,024	7,210	--	4,776	1,739	28,658	37,457	8,423	64,520	3,630	32,279	70	262
Soft maple	131,845	18,103	--	1,460	14,120	13,497	23,858	4,953	33,325	4,057	18,472	--	--
Ash	538,086	54,957	1,377	14,972	5,860	88,929	92,853	28,688	157,780	15,460	76,998	--	212
Balsam poplar	548,624	62,455	1,091	24,621	4,955	103,048	112,710	37,560	130,114	14,584	57,227	108	151
Paper birch	1,273,982	240,812	1,840	36,306	9,046	178,606	272,388	67,148	209,877	62,146	194,559	88	1,166
Bigtooth aspen	174,315	5,760	134	2,364	397	33,426	36,049	7,240	40,364	6,570	41,746	--	265
Quaking aspen	3,236,405	549,715	9,557	115,918	19,595	518,351	684,905	188,751	652,602	112,222	380,839	2,755	1,195
Basswood	402,424	28,068	--	15,616	3,468	33,974	59,554	9,707	168,628	11,643	70,441	--	1,325
Elm	431,437	13,488	480	8,672	6,698	36,215	45,670	9,776	243,085	7,539	57,562	--	2,252
Select hardwoods	18,316	--	--	--	139	1,873	403	--	13,411	696	1,794	--	--
Other hardwoods	65,668	--	--	62	4,106	4,259	118	--	49,515	958	6,650	--	--
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	7,976,990	1,000,000	14,563	237,983	76,418	1,123,941	1,445,557	370,962	2,322,655	265,590	1,106,711	3,021	9,589
All species	11,453,997	1,871,066	37,377	374,578	96,569	1,942,162	2,012,295	636,003	2,706,209	364,071	1,399,022	3,764	10,881

Table 17.--Net volume of sawtimber on commercial forest land by species group and ownership class, Minnesota, 1977

(In thousand board feet)[1/]

Species	All owners	Ownership class											
		National Forest	Bureau of Land Mgmt.	Indian	Misc. Federal	State	County & municipal	Forest Industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv. leased
SOFTWOODS													
White pine	1,068,372	394,746	1,625	61,881	8,028.	88,087	135,016	71,963	168,052	31,346	103,315	--	4,313
Red pine	1,952,896	827,988	3,970	82,942	5,087	218,637	293,305	76,379	226,166	30,435	187,987	--	--
Jack pine	1,566,444	420,047	26,103	26,010	14,712	295,928	236,124	87,328	253,477	41,542	164,294	879	--
White spruce	648,730	183,093	7,353	20,503	5,391	91,818	118,397	55,945	73,495	22,259	70,008	468	--
Black spruce	460,401	139,187	2,280	7,237	4,580	163,130	51,093	43,448	19,058	10,444	19,944	--	--
Balsam fir	1,338,249	341,533	1,996	32,973	11,523	216,563	306,820	108,577	147,402	44,961	125,373	--	528
Tamarack	346,508	26,681	1,174	19,298	2,771	130,810	42,638	5,618	80,751	8,936	27,831	--	--
Northern white-cedar	1,142,761	217,274	6,376	57,153	6,510	383,199	165,677	147,545	45,783	28,493	84,751	--	--
Other softwoods	6,228	--	--	--	--	364	--	--	3,581	821	1,462	--	--
Total	8,530,589	2,550,549	50,877	307,997	58,602	1,588,536	1,349,070	596,803	1,017,765	219,237	784,965	1,347	4,841
HARDWOODS													
Select white oak	1,076,044	25,896	429	13,597	5,372	49,035	41,196	1,220	786,380	18,428	129,610	--	4,881
Select red oak	1,763,622	13,077	--	6,982	11,194	160,531	104,125	5,014	1,084,804	44,897	329,567	--	3,431
Other red oak	56,414	--	--	--	2,058	3,007	290	--	49,371	--	1,688	--	--
Hickory	32,383	--	--	--	637	285	989	--	29,539	--	933	--	--
Yellow birch	39,926	1,606	--	--	--	2,755	22,413	3,290	903	4,502	4,457	--	--
Hard maple	489,619	6,668	--	9,720	3,869	71,846	81,504	16,620	208,839	3,841	86,712	--	--
Soft maple	281,998	10,900	--	1,088	81,748	20,518	29,770	5,038	94,607	5,418	32,911	--	--
Ash	993,952	88,212	2,258	20,646	20,577	129,499	156,737	52,598	357,578	24,091	140,943	--	813
Balsam poplar	1,101,406	144,889	1,916	37,980	3,937	206,987	253,307	74,119	244,099	30,580	102,188	523	881
Paper birch	1,234,388	276,079	1,058	50,296	16,037	185,600	197,057	75,316	203,453	41,735	187,447	--	310
Bigtooth aspen	303,391	12,135	--	3,767	695	40,387	51,585	18,943	92,045	13,876	69,218	--	740
Quaking aspen	5,671,280	1,068,447	21,668	205,049	39,243	836,043	1,219,322	356,277	1,042,614	234,038	642,280	2,168	4,131
Basswood	1,116,835	36,841	--	33,986	8,114	83,137	106,332	15,521	588,125	27,875	210,393	--	6,511
Elm	1,607,307	55,474	1,777	23,756	28,484	117,399	151,743	37,656	942,695	25,310	212,793	--	10,220
Select hardwoods	40,192	--	--	--	440	3,129	--	--	30,534	1,591	4,498	--	--
Other hardwoods	267,851	--	--	304	22,293	14,959	--	--	204,298	3,026	22,971	--	--
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	16,076,608	1,740,224	29,106	407,171	244,698	1,925,117	2,416,370	661,612	5,959,884	479,208	2,178,609	2,691	31,918
All species	24,607,197	4,290,773	79,983	715,168	303,300	3,513,653	3,765,440	1,258,415	6,977,649	698,445	2,963,574	4,038	36,759

[1/]International 1/4-inch rule.

Table 18.--Net volume of growing stock on commercial forest land by forest type and stand-age class, Minnesota, 1977

(In thousand cubic feet)

Forest type	All classes	Stand-age class (years)					
		0-10	11-20	21-30	31-40	41-50	51-60
Jack pine	560,341	4,681	3,194	24,517	115,786	143,135	147,803
Red pine	379,361	2,491	6,730	8,577	40,312	32,630	33,291
White pine	104,078	--	491	--	1,329	10,419	7,950
Balsam fir	679,143	12,674	18,644	31,363	65,442	211,002	193,493
White spruce	49,960	304	384	1,721	4,189	15,454	11,761
Black spruce	493,495	3,624	17,395	32,662	39,987	61,332	101,045
Northern white-cedar	378,567	551	1,833	5,010	10,351	10,892	25,634
Tamarack	203,820	3,117	13,425	9,423	7,848	20,980	40,830
Oak-hickory	784,286	4,577	9,899	2,910	53,113	136,848	133,132
Elm-ash-cottonwood	584,282	9,677	14,165	14,278	18,361	67,374	102,512
Maple-basswood	1,212,875	8,049	14,472	15,438	80,412	173,660	234,623
Aspen	4,681,925	159,232	149,722	250,317	816,553	1,443,009	1,151,136
Paper birch	919,682	5,063	14,592	16,703	95,456	271,439	240,579
Balsam poplar	407,592	13,990	15,138	18,044	64,316	131,327	79,004
Nonstocked	14,590	13,886	151	--	106	348	--
All types	11,453,997	241,916	280,235	430,963	1,413,561	2,729,849	2,502,793

(Table 18 continued)

Forest type	Stand-age class (years)						
	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	87,204	9,132	12,811	9,533	2,545	--	--
Red pine	19,727	138,196	32,424	62,010	2,973	--	--
White pine	14,846	23,017	4,335	27,989	13,702	--	--
Balsam fir	88,787	29,075	11,850	13,682	3,131	--	--
White spruce	4,956	1,530	3,496	5,173	992	--	--
Black spruce	58,575	73,907	45,927	37,959	8,520	12,562	--
Northern white-cedar	47,916	33,323	55,880	53,773	46,602	84,195	2,607
Tamarack	17,067	17,772	18,679	6,886	29,083	18,204	506
Oak-hickory	138,917	92,210	78,731	82,756	45,926	5,267	--
Elm-ash-cottonwood	92,916	65,691	81,035	63,515	30,253	24,505	--
Maple-basswood	206,122	181,780	93,862	101,704	64,500	38,253	--
Aspen	472,625	144,095	68,134	20,870	3,743	2,489	--
Paper birch	118,869	84,430	51,101	14,231	7,219	--	--
Balsam poplar	46,627	27,224	10,434	1,488	--	--	--
Nonstocked	--	99	--	--	--	--	--
All types	1,415,154	921,481	568,699	501,569	259,189	185,475	3,113

Table 19.--Net volume of sawtimber on commercial forest land by forest type and stand-age class, Minnesota, 1977

(In thousand board feet)[1/]

Forest type	All ages	Stand-age class (years) 0-10	11-20	21-30	31-40	41-50	51-60
Jack pine	1,288,869	9,343	6,218	22,324	199,816	312,645	416,610
Red pine	1,498,128	11,046	11,662	6,336	75,180	98,259	112,932
White pine	491,854	--	3,736	--	3,307	40,202	32,307
Balsam fir	1,250,440	31,237	39,819	55,218	84,935	300,842	368,555
White spruce	133,068	--	--	4,544	6,443	18,527	29,463
Black spruce	404,865	3,928	9,103	13,554	22,714	49,318	86,363
Northern white-cedar	872,938	1,441	2,078	5,006	12,418	21,666	39,144
Tamarack	233,050	2,664	15,628	6,290	4,625	16,338	49,937
Oak-hickory	2,337,948	12,967	28,655	4,203	95,337	221,443	330,599
Elm-ash-cottonwood	1,526,492	13,316	27,471	24,880	38,480	150,895	253,577
Maple-basswood	3,896,085	26,002	29,931	24,429	155,330	348,427	655,637
Aspen	8,336,377	279,718	193,790	285,176	1,006,672	2,267,161	2,393,445
Paper birch	1,473,241	4,202	18,308	25,903	121,683	308,558	337,528
Balsam poplar	829,199	18,472	22,751	11,642	84,769	232,380	183,650
Nonstocked	34,643	32,595	417	--	--	895	--
All types	24,607,197	446,931	409,567	489,505	1,911,709	4,387,556	5,289,747

[1/] International 1/4-inch rule.

(Table 19 continued)

Forest type	Stand-age class (years) 61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	219,381	37,222	32,780	25,228	7,302	--	--
Red pine	81,587	628,588	134,002	325,654	12,882	--	--
White pine	66,361	116,519	16,464	136,463	76,495	--	--
Balsam fir	209,129	68,266	30,755	52,692	8,992	--	--
White spruce	18,619	5,938	16,568	28,260	4,706	--	--
Black spruce	40,053	97,774	40,778	23,422	8,775	9,083	--
Northern white-cedar	78,320	69,199	127,068	102,695	121,903	282,482	9,518
Tamarack	20,194	30,466	24,210	9,891	37,176	15,631	--
Oak-hickory	429,357	317,402	318,135	356,212	200,068	23,570	--
Elm-ash-cottonwood	240,906	195,014	208,672	200,558	79,853	92,870	--
Maple-basswood	732,621	738,672	390,415	353,538	291,066	150,017	--
Aspen	1,175,188	414,623	238,771	64,547	9,726	7,560	--
Paper birch	213,109	207,572	169,931	45,217	21,230	--	--
Balsam poplar	144,776	88,977	36,899	4,883	--	--	--
Nonstocked	--	736	--	--	--	--	--
All types	3,669,601	3,016,968	1,785,448	1,729,260	880,174	581,213	9,518

Table 20.--Net volume of sawtimber on commercial forest land by species and log grade class, Minnesota, 1977

(In thousand board feet)[1/]

Species	All grades	Log grade			
		1	2	3	Tie and timber
SOFTWOODS					
White pine	1,068,372	101,633	146,333	700,974	119,432
Red pine	1,952,896	151,193	186,563	1,542,011	73,129
Jack pine	1,566,444	1,391	53,461	1,495,796	15,796
White spruce	648,730	2,190	17,360	629,034	146
Black spruce	460,401	6,479	14,055	439,789	78
Balsam fir	1,338,249	--	13,261	1,285,687	39,301
Tamarack	346,508	3,957	10,773	331,742	36
Northern white-cedar	1,142,761	17,819	32,446	1,092,496	--
Other softwoods	6,228	10	23	6,195	--
Total	8,530,589	284,672	474,275	7,523,724	247,918
HARDWOODS					
Select white oak	1,076,044	40,767	171,287	608,910	255,080
Select red oak	1,763,622	71,582	331,943	1,091,131	268,966
Other red oak	56,414	1,451	8,001	32,870	14,092
Hickory	32,383	87	6,326	24,428	1,542
Yellow birch	39,926	3,187	9,709	25,601	1,429
Hard maple	489,619	19,152	85,665	349,452	35,350
Soft maple	281,998	17,829	48,707	210,422	5,040
Ash	993,952	47,439	251,585	642,582	52,346
Balsam poplar	1,101,406	29,452	119,818	835,032	117,104
Paper birch	1,234,388	37,102	227,058	859,796	110,432
Bigtooth aspen	303,391	8,453	37,686	235,034	22,218
Quaking aspen	5,671,280	77,940	624,308	4,222,979	746,053
Basswood	1,116,835	139,082	390,695	537,088	49,970
Elm	1,607,307	145,752	514,722	805,432	141,401
Select hardwoods	40,192	1,205	2,695	35,551	741
Other hardwoods	267,851	36,791	35,263	185,293	10,504
Total	16,076,608	677,271	2,865,468	10,701,601	1,832,268
All species	24,607,197	961,943	3,339,743	18,225,325	2,080,186

[1/] International 1/4-inch rule.

Table 21.--Net volume of short-log trees on commercial forest land by species group and diameter class, Minnesota, 1977

(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS											
White pine	1,729	311	85	286	420	89	86	--	366	86	--
Red pine	785	191	265	148	--	109	72	--	--	--	--
Jack pine	4,109	1,685	1,201	843	308	72	--	--	--	--	--
White spruce	264	117	66	--	81	--	--	--	--	--	--
Black spruce	1,208	951	91	--	166	--	--	--	--	--	--
Balsam fir	4,229	2,674	530	141	236	648	--	--	--	--	--
Tamarack	2,462	1,343	887	83	61	88	--	--	--	--	--
Northern white-cedar	11,883	4,538	3,529	1,256	1,115	1,007	267	83	88	--	--
Other softwoods	391	248	--	--	73	--	70	--	--	--	--
Total	27,060	12,058	6,654	2,757	2,460	2,013	495	83	454	86	--
HARDWOODS											
Select white oak	16,071	--	3,734	2,337	3,373	1,761	1,474	1,450	1,322	620	--
Select red oak	13,346	--	2,965	3,523	2,109	1,765	721	1,139	976	148	--
Other red oak	385	--	43	115	--	71	89	67	--	--	--
Hickory	200	--	37	96	--	--	67	--	--	--	--
Yellow birch	2,057	--	176	568	88	211	--	90	924	--	--
Hard maple	10,015	--	1,980	2,855	2,135	861	1,249	248	597	90	--
Soft maple	3,388	--	185	530	428	315	487	178	479	437	349
Ash	5,367	--	2,381	1,244	1,073	354	56	99	114	46	--
Balsam poplar	5,239	--	1,630	1,207	400	1,379	254	225	107	--	37
Paper birch	11,929	--	5,092	2,830	2,578	511	661	134	123	--	--
Bigtooth aspen	3,398	--	1,222	1,100	405	671	--	--	--	--	--
Quaking aspen	60,256	--	26,475	15,301	10,405	5,368	1,900	371	432	4	--
Basswood	7,295	--	2,117	1,452	1,242	588	486	262	1,020	128	--
Elm	15,294	--	3,235	1,865	1,834	1,414	1,513	1,104	2,320	1,377	632
Select hardwoods	489	--	6	83	181	73	--	45	101	--	--
Other hardwoods	2,668	--	540	616	168	204	84	62	283	171	540
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--
Total	157,397	--	51,818	35,722	26,419	15,546	9,041	5,474	8,798	3,021	1,558
All species	184,457	12,058	58,472	38,479	28,879	17,559	9,536	5,557	9,252	3,107	1,558

Table 22.--Net volume of short-log trees on commercial forest land by species group and diameter class, Minnesota, 1977

(In thousand board feet)[1/]

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS											
White pine	6,237	1,181	387	1,034	1,792	411	213	--	889	330	--
Red pine	2,874	684	1,246	516	--	254	174	--	--	--	--
Jack pine	14,430	6,339	4,642	2,165	965	319	--	--	--	--	--
White spruce	1,513	754	332	--	427	--	--	--	--	--	--
Black spruce	3,770	3,184	368	--	218	--	--	--	--	--	--
Balsam fir	13,467	8,498	2,168	394	1,337	1,070	--	--	--	--	--
Tamarack	7,773	3,820	2,862	180	455	456	--	--	--	--	--
Northern white-cedar	41,088	17,962	12,155	3,915	2,990	2,794	665	207	400	--	--
Other softwoods	1,716	1,384	--	--	165	--	167	--	--	--	--
Total	92,868	43,806	24,160	8,204	8,349	5,304	1,219	207	1,289	330	--
HARDWOODS											
Select white oak	55,764	--	15,181	8,066	10,936	5,910	4,071	4,460	4,846	2,294	--
Select red oak	40,661	--	10,434	10,694	6,602	4,769	1,717	3,323	2,595	527	--
Other red oak	1,253	--	138	474	--	201	250	190	--	--	--
Hickory	700	--	119	381	--	--	200	--	--	--	--
Yellow birch	4,678	--	556	1,809	177	838	--	435	863	--	--
Hard maple	26,164	--	5,278	7,203	5,308	2,019	2,965	848	2,264	279	--
Soft maple	11,058	--	758	2,426	1,674	1,023	1,443	434	1,145	1,097	1,058
Ash	12,715	--	6,388	3,002	1,924	583	143	193	234	248	--
Balsam poplar	18,654	--	3,957	3,516	867	6,307	1,518	1,489	517	--	483
Paper birch	35,137	--	13,967	8,029	5,595	1,627	4,300	1,024	595	--	--
Bigtooth aspen	8,291	--	2,685	2,654	1,061	1,891	--	--	--	--	--
Quaking aspen	172,196	--	70,814	40,809	33,047	17,143	7,507	1,173	1,700	3	--
Basswood	18,770	--	4,526	2,785	2,515	1,479	1,047	833	4,596	989	--
Elm	58,460	--	13,939	7,758	6,914	5,506	4,379	3,479	8,038	4,944	3,503
Select hardwoods	1,656	--	56	30	743	386	--	203	238	--	--
Other hardwoods	15,221	--	3,327	3,257	1,260	1,089	584	363	912	1,059	3,370
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--
Total	481,378	--	152,123	102,893	78,623	50,771	30,124	18,447	28,543	11,440	8,414
All species	574,246	43,806	176,283	111,097	86,972	56,075	31,343	18,654	29,832	11,770	8,414

[1/] International 1/4-inch rule.

Table 23.--Net annual growth of growing stock on commercial forest land by softwoods and hardwoods, Minnesota, 1962[1/] and 1976

(In thousand cubic feet)

Species	1962	1976
Softwoods	106,789	119,781
Hardwoods	257,420	229,139
All species	364,209	348,920

[1/]Figures have been adjusted from those published after the 1962 survey to conform to 1977 volumes because of changes in survey definitions and procedures.

Table 24.--Net annual growth of growing stock on commercial forest land by species group and Forest Survey Unit, Minnesota, 1976

(In thousand cubic feet)

Species	All units	Aspen-Birch	Northern Pine	Central Hardwood	Prairie
SOFTWOODS					
White pine	5,599	2,367	2,779	453	--
Red pine	15,684	5,811	8,742	1,113	18
Jack pine	25,677	5,799	19,216	649	13
White spruce	10,701	7,328	3,228	126	19
Black spruce	16,520	11,358	4,947	211	4
Balsam fir	31,902	17,912	13,570	402	18
Tamarack	2,269	(-)343	2,092	508	12
Northern white-cedar	11,274	6,747	4,527	--	--
Other softwoods	155	3	22	100	30
Total	119,781	56,982	59,123	3,562	114
HARDWOODS					
Select white oak	8,733	140	3,213	4,294	1,086
Select red oak	15,691	191	6,034	9,025	441
Other red oak	256	--	29	214	13
Hickory	455	--	12	429	14
Yellow birch	118	30	85	3	--
Hard maple	8,660	1,298	2,535	4,335	492
Soft maple	6,454	1,574	1,813	2,940	127
Ash	9,468	3,996	3,621	1,538	313
Balsam poplar	17,757	6,229	9,429	833	1,266
Paper birch	30,290	10,619	15,829	3,761	81
Bigtooth aspen	1,086	409	341	332	4
Quaking aspen	93,083	31,322	45,739	11,430	4,592
Basswood	17,252	891	6,228	8,516	1,617
Elm	18,022	1,248	5,617	10,307	850
Select hardwoods	440	4	73	306	57
Other hardwoods	1,374	(-)34	71	470	867
Noncommercial species	--	--	--	--	--
Total	229,139	57,917	100,669	58,733	11,820
All species	348,920	114,899	159,792	62,295	11,934

Table 25.--Net annual growth of sawtimber on commercial forest land by species group and Forest Survey Unit, Minnesota, 1976

(In thousand board feet)[1/]

Species	All units	Aspen-Birch	Northern Pine	Central Hardwood	Prairie
SOFTWOODS					
White pine	33,304	15,969	14,775	2,560	--
Red pine	74,768	25,414	48,197	1,064	93
Jack pine	88,650	30,665	56,971	981	33
White spruce	36,750	23,581	12,764	347	58
Black spruce	18,568	14,758	3,800	10	--
Balsam fir	86,053	48,647	36,542	864	--
Tamarack	8,460	6	5,698	2,743	13
Northern white-cedar	33,003	19,486	13,517	--	--
Other softwoods	763	--	664	71	28
Total	380,319	178,526	192,928	8,640	225
HARDWOODS					
Select white oak	30,845	199	9,585	16,546	4,515
Select red oak	61,191	658	19,759	38,201	2,573
Other red oak	960	--	3	909	48
Hickory	1,484	--	6	1,456	22
Yellow birch	612	428	166	18	--
Hard maple	30,649	2,639	6,239	19,508	2,263
Soft maple	18,380	1,574	3,278	10,481	3,047
Ash	18,003	6,377	5,340	5,078	1,208
Balsam poplar	51,922	22,274	25,742	812	3,094
Paper birch	53,434	23,611	26,074	3,715	34
Bigtooth aspen	11,116	1,130	10,651	(-)665	--
Quaking aspen	330,071	132,104	157,084	34,262	6,621
Basswood	48,788	2,452	12,042	27,208	7,086
Elm	61,699	6,113	18,524	34,852	2,210
Select hardwoods	2,261	--	444	1,564	253
Other hardwoods	9,730	(-)19	287	3.358	6,104
Noncommercial species	--	--	--	--	--
Total	731,145	199,540	295,224	197,303	39,078
All species	1,111,464	378,066	488,152	205,943	39,303

[1/] International 1/4-inch rule.

Table 26.--Net annual growth of growing stock on commercial forest land by species group and ownership class, Minnesota, 1976

(In thousand cubic feet)

Species	All owners	Ownership class											
		National Forest	Bureau of Land Mgmt.	Indian	Misc. Federal	State	County & municipal	Forest Industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
SOFTWOODS													
White pine	5,599	1,555	27	488	1	382	911	432	1,003	182	581	--	37
Red pine	15,684	6,044	158	630	16	1,582	2,040	1,009	1,565	235	2,405	--	--
Jack pine	25,677	4,407	410	543	387	3,870	4,368	2,911	4,738	960	3,073	10	--
White spruce	10,701	1,965	75	269	85	3,222	1,978	688	1,148	298	960	13	--
Black spruce	16,520	2,827	139	550	98	6,155	3,051	1,232	1,093	509	850	16	--
Balsam fir	31,902	6,364	34	1,350	206	5,974	9,690	1,278	3,728	950	2,317	--	11
Tamarack	2,269	538	11	61	43	340	325	210	(-)175	249	667	--	--
Northern white-cedar	11,274	1,411	131	1,289	47	4,288	1,287	1,112	733	230	746	--	--
Other softwoods	155	--	--	--	--	49	3	--	78	20	5	--	--
Total	119,781	25,111	985	5,180	883	25,862	23,653	8,872	13,911	3,633	11,604	39	48
HARDWOODS													
Select white oak	8,733	178	2	212	32	761	565	45	5,727	196	988	--	27
Select red oak	15,691	388	--	195	109	1,535	1,558	200	6,938	311	4,412	--	45
Other red oak	256	--	--	--	6	29	16	--	193	--	12	--	--
Hickory	455	--	--	8	9	6	4	--	385	--	43	--	--
Yellow birch	118	(-)84	--	--	--	22	94	14	14	18	40	--	--
Hard maple	8,660	208	--	174	54	1,461	631	(-)36	3,984	302	1,874	3	5
Soft maple	6,454	1,104	--	73	409	884	816	140	1,546	177	1,305	--	--
Ash	9,468	2,189	32	404	(-)62	1,434	767	(-)9	2,371	393	1,944	--	5
Balsam poplar	17,757	2,247	201	1,445	502	3,126	2,586	483	4,582	792	1,781	7	5
Paper birch	30,290	2,886	47	788	220	4,433	7,066	1,870	6,458	1,472	5,012	1	37
Bigtooth aspen	1,086	(-)1	7	81	13	1,221	(-)764	(-)525	182	226	639	--	7
Quaking aspen	93,083	15,412	430	4,006	794	19,028	12,866	4,162	19,933	1,267	15,211	(-)64	38
Basswood	17,252	911	--	530	116	1,265	2,383	298	8,012	504	3,165	--	68
Elm	18,022	354	23	451	218	1,717	1,938	385	9,782	474	2,520	--	160
Select hardwoods	440	--	--	--	3	75	20	--	254	21	67	--	--
Other hardwoods	1,374	--	--	1	105	193	4	--	789	40	242	--	--
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	229,139	25,792	742	8,368	2,528	37,190	30,550	7,027	71,150	6,193	39,255	(-)53	397
All species	348,920	50,903	1,727	13,548	3,411	63,052	54,203	15,899	85,061	9,826	50,859	(-)14	445

Table 27.--Net annual growth of sawtimber on commercial forest land by species group and ownership class, Minnesota, 1976

(In thousand board feet)[1/]

Species	All owners	Ownership class											
		National Forest	Bureau of Land Mgmt.	Indian	Misc. Federal	State	County & municipal	Forest Industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
SOFTWOODS													
White pine	33,304	12,806	64	2,017	(-)39	1,755	4,177	2,914	5,877	800	2,822	--	111
Red pine	74,768	30,280	932	3,486	109	6,532	12,338	4,638	7,800	902	7,751	--	--
Jack pine	88,650	25,996	1,909	58	400	12,350	12,722	8,228	16,617	746	9,597	27	--
White spruce	36,750	7,226	401	1,130	275	6,373	6,976	1,727	6,183	1,302	5,096	61	--
Black spruce	18,568	9,481	45	113	135	3,183	1,898	1,476	1,624	298	315	--	--
Balsam fir	86,053	21,684	58	1,460	263	15,806	22,240	6,201	9,975	(-)109	8,459	--	16
Tamarack	8,460	1,351	19	82	77	824	1,845	154	389	224	3,495	--	--
Northern white-cedar	33,003	8,653	119	2,113	131	11,372	4,024	2,568	777	1,212	2,034	--	--
Other softwoods	763	--	--	--	--	664	--	--	68	14	17	--	--
Total	380,319	117,477	3,547	10,459	1,351	58,859	66,220	27,906	49,310	5,389	39,586	88	127
HARDWOODS													
Select white oak	30,845	699	8	215	75	1,518	1,496	13	23,298	958	2,463	--	102
Select red oak	61,191	488	--	523	544	5,903	4,033	1,171	33,633	(-)364	15,195	--	65
Other red oak	960	--	--	--	31	53	1	--	840	--	35	--	--
Hickory	1,484	--	--	--	16	8	13	--	1,423	--	24	--	--
Yellow birch	612	154	--	--	--	38	239	42	17	61	61	--	--
Hard maple	30,649	626	--	738	135	2,941	2,380	644	19,894	93	3,198	--	--
Soft maple	18,380	1,171	--	13	1,499	745	464	53	10,497	95	3,843	--	--
Ash	18,003	2,590	35	318	2,423	3,362	3,728	(-)18	1,222	383	3,948	--	12
Balsam poplar	51,922	5,790	711	2,691	99	10,073	13,087	3,484	13,396	842	1,688	33	28
Paper birch	53,434	14,865	5	1,537	673	3,324	7,402	3,732	12,032	963	8,895	--	6
Bigtooth aspen	11,116	1,533	--	832	13	3,015	(-)207	853	1,273	304	3,488	--	12
Quaking aspen	330,071	59,251	1,868	9,001	2,279	52,228	72,551	19,979	55,609	4,690	52,477	64	74
Basswood	48,788	2,433	--	1,155	210	3,231	3,947	1,042	24,661	2,287	9,521	--	301
Elm	61,699	1,858	56	1,269	307	5,307	7,474	1,437	31,136	1,112	11,053	--	690
Select hardwoods	2,261	--	--	--	2	251	--	--	1,863	38	107	--	--
Other hardwoods	9,730	--	--	4	392	262	--	--	7,562	73	1,437	--	--
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	731,145	91,458	2,683	18,296	8,698	92,259	116,608	32,432	238,356	11,535	117,433	97	1,290
All species	1,111,464	208,935	6,230	28,755	10,049	151,118	182,828	60,338	287,666	16,924	157,019	185	1,417

[1/]International 1/4-inch rule.

Table 28.--Net annual growth of growing stock on commercial forest land by species group and forest type, Minnesota, 1976

(In thousand cubic feet)

Species	All types	Forest type						
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
SOFTWOODS								
White pine	5,599	119	1,168	1,247	320	35	89	37
Red pine	15,684	1,780	8,797	387	346	42	48	59
Jack pine	25,677	20,768	667	111	172	78	405	87
White spruce	10,701	226	266	267	1,517	1,190	464	34
Black spruce	16,520	438	54	(-)67	2,060	47	11,517	168
Balsam fir	31,902	375	564	(-)532	8,260	188	1,032	169
Tamarack	2,269	5	14	--	129	(-)819	732	84
Northern white-cedar	11,274	--	11	8	1,334	43	376	6,959
Other softwoods	155	--	25	--	--	--	10	--
Total	119,781	23,711	11,566	1,421	14,138	804	14,673	7,597
HARDWOODS								
Select white oak	8,733	31	8	14	18	1	--	--
Select red oak	15,691	94	33	15	4	--	6	--
Other red oak	256	--	--	--	--	--	--	--
Hickory	455	--	--	--	--	--	--	--
Yellow birch	118	--	--	--	7	--	--	15
Hard maple	8,660	--	--	3	19	--	--	--
Soft maple	6,454	146	3	41	44	--	6	1
Ash	9,468	2	6	13	261	(-)310	50	(-)24
Balsam poplar	17,757	33	36	4	(-)819	34	40	198
Paper birch	30,290	495	411	(-)24	2,344	296	239	150
Bigtooth aspen	1,086	(-)576	(-)118	1	14	--	88	10
Quaking aspen	93,083	1,655	(-)30	196	2,261	480	1,143	117
Basswood	17,252	5	--	11	36	--	--	--
Elm	18,022	8	3	--	69	(-)129	6	5
Select hardwoods	440	--	--	--	--	--	--	--
Other hardwoods	1,374	12	4	--	--	--	--	--
Noncommercial species	--	--	--	--	--	--	--	--
Total	229,139	1,905	356	274	4,258	372	1,578	472
All species	348,920	25,616	11,922	1,695	18,396	1,176	16,251	8,069

(Table 28 continued on next page)

(Table 28 continued)

Species	Forest type							
	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
SOFTWOODS								
White pine	54	87	53	332	1,558	491	9	--
Red pine	13	245	14	20	3,172	745	16	--
Jack pine	32	252	21	1	2,687	292	22	82
White spruce	52	(-)49	149	318	5,143	816	308	--
Black spruce	840	--	54	(-)17	1,338	(-)4	78	14
Balsam fir	133	30	584	554	14,662	4,339	1,335	209
Tamarack	2,690	4	(-)402	109	(-)240	(-)104	37	30
Northern white-cedar	192	--	882	130	1,107	2	219	11
Other softwoods	--	71	4	28	--	9	8	--
Total	4,006	640	1,359	1,475	29,427	6,586	2,032	346
HARDWOODS								
Select white oak	--	3,983	174	1,311	2,895	245	48	5
Select red oak	7	8,207	348	1,759	4,293	906	19	--
Other red oak	--	172	4	38	38	1	3	--
Hickory	--	363	--	75	--	17	--	--
Yellow birch	--	--	36	20	7	31	2	--
Hard maple	--	390	249	6,464	1,212	269	52	2
Soft maple	14	275	882	1,197	2,914	916	15	--
Ash	16	240	4,202	1,317	2,895	399	385	16
Balsam poplar	121	95	556	(-)293	7,395	616	9,819	(-)78
Paper birch	80	1,486	370	1,669	10,854	11,349	528	43
Bigtooth aspen	--	351	32	(-)88	1,977	(-)618	13	--
Quaking aspen	(-)47	1,033	236	1,609	81,400	921	2,033	76
Basswood	--	1,772	442	11,089	3,315	566	16	--
Elm	86	1,632	2,267	8,762	3,871	762	646	34
Select hardwoods	--	132	26	162	98	16	3	3
Other hardwoods	--	139	933	187	80	--	13	6
Noncommercial species	--	--	--	--	--	--	--	--
Total	277	20,270	10,757	35,278	123,244	16,396	13,595	107
All species	4,283	20,910	12,116	36,753	152,671	22,982	15,627	453

Table 29.--Net annual growth of sawtimber on commercial forest land by species group and forest type, Minnesota, 1976

(In thousand board feet)[1/]

Species	All types	Forest type						
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
SOFTWOODS								
White pine	33,304	356	8,612	9,399	1,653	215	497	255
Red pine	74,768	6,511	40,989	2,353	1,539	104	204	636
Jack pine	88,650	62,359	1,673	215	544	193	3,219	375
White spruce	36,750	365	1,008	2,110	5,639	3,452	897	(-)24
Black spruce	18,568	670	16	30	4,272	23	4,961	(-)188
Balsam fir	86,053	166	2,183	210	19,181	482	2,032	483
Tamarack	8,460	24	10	--	1,201	(-)2,795	2,718	240
Northern white-cedar	33,003	--	36	8	4,679	170	1,674	11,945
Other softwoods	763	--	--	--	--	--	--	--
Total	380,319	70,451	54,527	14,325	38,708	1,844	16,202	13,722
HARDWOODS								
Select white oak	30,845	7	--	13	36	--	--	--
Select red oak	61,191	37	43	62	5	--	--	--
Other red oak	960	--	--	--	--	--	--	--
Hickory	1,484	--	--	--	--	--	--	--
Yellow birch	612	--	--	--	6	--	--	24
Hard maple	30,649	--	--	17	--	--	--	--
Soft maple	18,380	--	--	6	770	--	9	--
Ash	18,003	--	--	9	303	(-)1,516	114	130
Balsam poplar	51,922	42	--	--	1,140	14	22	971
Paper birch	53,434	1,062	1,607	42	3,917	400	33	115
Bigtooth aspen	11,116	26	5	--	24	--	7	10
Quaking aspen	330,071	3,498	1,341	(-)355	6,006	346	2,877	266
Basswood	48,788	--	--	25	88	--	--	--
Elm	61,699	13	--	--	133	(-)520	--	21
Select hardwoods	2,261	--	--	--	--	--	--	--
Other hardwoods	9,730	--	--	--	--	--	--	--
Noncommercial species	--	--	--	--	--	--	--	--
Total	731,145	4,685	2,996	(-)181	12,429	(-)1,276	3,061	1,537
All species	1,111,464	75,136	57,523	14,144	51,136	568	19,264	15,259

(Table 29 continued on next page)

1/International 1/4-inch rule.

(Table 29 continued)

Species	Forest type							
	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
SOFTWOODS								
White pine	259	445	277	1,667	7,179	2,435	55	--
Red pine	61	765	24	113	17,685	3,705	79	--
Jack pine	50	325	38	(-)18	18,930	629	(-)158	276
White spruce	85	(-)365	883	1,330	15,688	3,970	1,712	--
Black spruce	348	--	38	715	7,318	212	129	24
Balsam fir	173	14	(-)342	6,472	39,017	9,676	5,446	860
Tamarack	7,270	26	(-)632	192	(-)972	650	494	34
Northern white-cedar	1,333	--	3,734	1,111	7,752	(-)58	588	31
Other softwoods	--	69	15	30	--	--	649	--
Total	9,579	1,279	4,035	11,612	112,597	21,219	8,994	1,225
HARDWOODS								
Select white oak	--	13,612	559	7,536	8,107	882	81	12
Select red oak	39	34,649	20	6,967	15,184	4,120	65	--
Other red oak	--	702	23	187	31	--	17	--
Hickory	--	473	--	949	--	62	--	--
Yellow birch	--	--	105	404	7	60	6	--
Hard maple	--	766	215	27,199	1,900	540	12	--
Soft maple	--	1,978	5,668	1,682	8,151	116	--	--
Ash	--	279	7,714	3,970	3,567	1,486	1,915	32
Balsam poplar	141	127	1,109	1,811	18,374	3,315	24,856	--
Paper birch	16	1,152	1,220	4,607	23,456	15,660	138	9
Bigtooth aspen	--	633	51	(-)117	11,700	)1,223	--	--
Quaking aspen	80	5,180	883	5,008	286,167	8,485	10,116	173
Basswood	--	5,328	2,089	36,014	3,989	1,191	64	--
Elm	29	2,575	10,634	28,735	16,165	1,828	1,990	96
Select hardwoods	--	1,681	9	457	81	33	--	--
Other hardwoods	--	146	5,332	4,168	66	--	--	18
Noncommercial species	--	--	--	--	--	--	--	--
Total	305	69,280	35,631	129,578	396,945	36,555	39,260	340
All species	9,884	70,560	39,666	141,189	509,542	57,774	48,254	1,565

Table 30.--Net annual growth of growing stock on commercial forest land by forest type and stand-age class, Minnesota, 1976

(In thousand cubic feet)

Forest type	All ages	Stand-age class (years)					
		0-10	11-20	21-30	31-40	41-50	51-60
Jack pine	25,616	111	17	3,146	7,134	6,722	5,410
Red pine	11,922	100	836	767	2,331	1,102	1,262
White pine	1,695	(-)29	20	--	88	608	123
Balsam fir	18,396	410	280	1,026	2,883	7,584	3,295
White spruce	1,176	(-)395	30	116	217	(-)94	861
Black spruce	16,251	75	742	1,123	1,369	2,377	3,595
Northern white-cedar	8,069	22	67	137	190	100	855
Tamarack	4,283	103	337	130	322	489	913
Oak-hickory	20,910	43	364	(-)18	1,812	4,911	3,929
Elm-ash-cottonwood	12,116	(-)689	523	500	1,000	2,599	1,935
Maple-basswood	36,753	186	465	907	3,809	5,367	7,969
Aspen	152,671	(-)1,571	7,875	13,982	34,047	46,803	35,933
Paper birch	22,982	110	697	705	2,782	8,228	5,039
Balsam poplar	15,627	397	779	1,520	3,516	4,762	2,258
Nonstocked	453	524	6	--	(-)98	19	--
All types	348,920	(-)603	13,038	24,041	61,402	91,577	73,377

(Table 30 continued)

Forest type	Stand-age class (years)						
	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	2,882	284	(-)86	(-)53	49	--	--
Red pine	649	3,084	620	1,089	82	--	--
White pine	479	265	138	(-)210	213	--	--
Balsam fir	2,841	174	(-)370	173	100	--	--
White spruce	191	30	99	101	20	--	--
Black spruce	1,930	2,233	1,313	1,019	94	381	--
Northen white-cedar	1,241	784	1,539	942	618	1,492	82
Tamarak	587	306	(-)309	144	880	369	12
Oak-hikory	3,876	2,574	557	1,809	922	131	--
Elm-ash-cottonwood	1,822	588	1,760	1,131	511	436	--
Maple-basswood	6,685	4,734	2,681	2,306	706	938	--
Aspen	11,096	2,881	1,099	400	65	61	--
Paper birch	2,662	1,797	774	35	153	--	--
Balsam poplar	1,215	822	318	40	--	--	--
Nonstocked	--	2	--	--	--	--	--
All types	38,156	20,558	10,133	8,926	4,413	3,808	94

Table 31.--Net annual growth of sawtimber on commercial forest land by forest type and stand-age class, Minnesota, 1976

(In thousand board feet)[1/]

Forest type	All ages	Stand-age class (years) 0-10	11-20	21-30	31-40	41-50	51-60
Jack pine	75,136	(-)567	719	1,967	15,932	24,704	19,078
Red pine	57,523	360	1,165	372	6,891	4,925	5,904
White pine	14,144	--	131	--	664	1,310	804
Balsam fir	51,136	1,594	455	1,331	5,471	16,623	16,663
White spruce	568	(-)2,036	--	261	198	(-)1,866	981
Black spruce	19,264	94	777	848	1,528	2,797	6,609
Northern white-cedar	15,259	33	48	103	(-)1	(-)696	794
Tamarack	9,884	61	836	166	121	1,965	3,510
Oak-hickory	70,560	(-)152	754	97	3,270	10,004	11,277
Elm-ash-cottonwood	39,666	(-)305	693	1,020	2,027	10,460	3,939
Maple-basswood	141,189	2,116	3,654	(-)276	12,363	13,065	29,692
Aspen	509,542	3,970	15,151	30,531	79,956	166,023	132,793
Paper birch	57,774	182	435	1,455	6,578	19,370	11,100
Balsam poplar	48,254	(-)1,482	341	375	7,199	18,166	9,914
Nonstocked	1,565	1,524	5	--	--	20	--
All types	1,111,464	5,392	25,164	38,250	142,197	286,870	253,058

[1/] International 1/4-inch rule.

(Table 31 continued)

Forest type	Stand-age class (years) 61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	9,840	1,233	986	1,121	123	--	--
Red pine	2,833	20,814	4,892	8,657	710	--	--
White pine	3,019	2,586	444	3,926	1,260	--	--
Balsam fir	5,691	3,255	(-)686	509	230	--	--
White spruce	1,444	117	381	988	100	--	--
Black spruce	1,308	2,631	774	1,603	157	138	--
Northen white-cedar	2,753	2,255	4,595	1,769	143	3,270	193
Tamarack	494	(-)310	1,208	282	1,247	304	--
Oak-hickory	16,819	13,071	1,890	9,428	3,551	551	--
Elm-ash-cottonwood	4,143	5,014	5,752	3,838	1,329	1,756	--
Maple-basswood	21,401	26,144	13,460	9,366	6,039	4,165	--
Aspen	52,045	17,277	9,437	1,778	451	130	--
Paper birch	7,110	5,656	3,857	1,724	307	--	--
Balsam poplar	9,142	2,709	1,361	529	--	--	--
Nonstocked	--	16	--	--	--	--	--
All types	138,042	102,468	48,351	45,518	15,647	10,314	193

Table 32.--Timber removals[1] from growing stock and sawtimber on commercial forest land by species group, Minnesota, 1962 and 1976

Species	Growing stock		Sawtimber	
	[2]1962	1976	[2]1962	1976
	Thousand cubic feet		[3]Thousand board feet	
SOFTWOODS				
White pine	3,620	2,910	20,759	13,190
Red pine	3,416	4,177	15,976	15,214
Jack pine	22,678	21,470	54,844	56,934
Spruce	20,589	17,943	45,600	38,809
Balsam fir	12,601	13,893	20,860	27,000
Tamarack	3,485	4,982	6,305	10,165
Northern white-cedar	2,445	3,315	4,586	8,548
Other	66	110	49	82
Total	68,900	68,800	168,979	169,942
HARDWOODS				
White oak	4,738	5,119	12,763	11,856
Red oak	6,743	10,102	21,149	26,782
Yellow birch	441	16	1,840	41
Hard maple	1,036	1,388	2,534	3,297
Soft maple	1,273	2,840	3,737	5,992
Ash	2,632	5,063	6,781	10,247
Paper birch	3,408	9,113	8,476	13,865
Aspen	45,675	72,979	85,089	172,530
Basswood	2,941	3,529	12,773	10,162
Elm	4,180	7,813	13,872	21,143
Other	3,933	6,838	10,903	14,450
Total	77,000	124,800	179,917	290,365
All species	145,900	193,600	348,896	460,307

[1]/Removals in 1976 are trend-level removals. "Other" removals from the transfer of commercial forest land to productive-reserved are not included in 1976 removals.

[2]/Figures have been adjusted from those published after the 1962 survey to conform to 1976 volumes because of changes in survey definitions and procedures.

[3]/International 1/4-inch rule.

Table 33.--Timber removals[1/] from growing stock and sawtimber on commercial forest land by item and species category, Minnesota, 1976

Item	Growing stock						Sawtimber					
	All species	Jack pine	Spruce	Other soft-woods	Aspen	Other hard-woods	All species	Jack pine	Spruce	Other soft-woods	Aspen	Other hard-woods
	Thousand cubic feet						[2/]Thousand board feet					
ROUNDWOOD PRODUCTS												
Pulpwood	89,880	13,289	15,188	14,688	42,625	4,090	195,011	26,776	33,977	32,563	99,174	2,521
Saw logs	27,498	5,363	582	4,987	9,006	7,560	135,220	26,743	2,895	27,530	36,805	41,247
Fuelwood	9,065	374	?	135	1,704	6,850	12,683	519	6	195	2,367	9,596
Posts	1,799	723	--	821	20	235	1,206	309	--	347	45	505
Veneer logs	460	--	--	--	65	395	3,059	--	--	--	420	2,639
Poles	610	271	--	339	--	--	1,758	784	--	974	--	--
Other[3/]	5,723	50	--	138	4,607	928	24,986	235	--	729	18,601	5,421
Subtotal	135,035	20,070	15,772	21,108	58,027	20,058	373,923	55,366	36,878	62,338	157,412	61,929
LOGGING RESIDUE	5,060	418	282	457	2,284	1,619	6,954	299	12	519	1,930	4,194
OTHER REMOVALS	53,505	982	1,889	7,822	12,668	30,144	79,430	1,269	1,919	11,342	13,188	51,712
TOTAL	193,600	21,470	17,943	29,387	72,979	51,821	460,307	56,934	38,809	74,199	172,530	117,835

[1/]Removals in 1976 are trend-level removals. "Other" removals from the transfer of commercial forest land to productive-reserved are not included in 1976 removals.

[2/]International 1/4-inch rule.

[3/]Includes match bolts, particleboard bolts, shavings bolts, piling, lath bolts, etc.

Table 34.--Timber removals[1/] from growing stock on commercial forest land by species group and Forest Survey Unit, Minnesota, 1976

(In thousand cubic feet)

Species	All units	Aspen-Birch	Northern Pine	Central Hardwood	Prairie
SOFTWOODS					
White pine	2,910	1,711	1,013	186	--
Red pine	4,177	1,485	2,540	132	20
Jack pine	21,470	10,718	10,259	484	9
White spruce	4,188	2,888	1,265	20	15
Black spruce	13,755	10,275	3,458	21	1
Balsam fir	13,893	7,728	6,040	119	6
Tamarack	4,982	2,503	2,126	304	49
Northern white-cedar	3,315	1,495	1,801	1	18
Other softwoods	110	--	--	72	38
Total	68,800	38,803	28,502	1,339	156
HARDWOODS					
Select white oak	5,119	10	595	3,136	1,378
Select red oak	9,779	113	1,980	7,255	431
Other red oak	323	--	8	299	16
Hickory	198	--	5	182	11
Yellow birch	16	3	8	5	--
Hard maple	1,388	28	319	813	228
Soft maple	2,840	77	269	2,356	138
Ash	5,063	302	1,237	2,893	631
Balsam poplar	3,078	1,044	1,455	207	372
Paper birch	9,113	3,253	4,540	1,265	55
Bigtooth aspen	3,444	665	2,202	577	--
Quaking aspen	69,535	32,686	30,440	4,965	1,444
Basswood	3,529	48	805	2,000	676
Elm	7,813	207	1,050	4,620	1,936
Select hardwoods	66	--	--	54	12
Other hardwoods	3,496	9	13	2,231	1,243
Noncommercial species	--	--	--	--	--
Total	124,800	38,445	44,926	32,858	8,571
All species	193,600	77,248	73,428	34,197	8,727

[1/]Removals in 1976 are trend-level removals. "Other" removals from the transfer of commercial forest land to productive-reserved are not included in 1976 removals.

Table 35.--Timber removals[1] from sawtimber on commercial forest land by species group and Forest Survey Unit, Minnesota, 1976

(In thousand board feet)[2]

Species	All units	Aspen-Birch	Northern Pine	Central Hardwood	Prairie
SOFTWOODS					
White pine	13,190	7,641	5,026	523	--
Red pine	15,214	4,210	10,535	405	64
Jack pine	56,934	27,678	27,943	1,296	17
White spruce	12,679	6,368	6,224	54	33
Black spruce	26,130	21,857	4,269	4	--
Balsam fir	27,000	15,329	11,563	108	--
Tamarack	10,165	5,237	4,523	318	87
Northern white-cedar	8,548	4,948	3,568	8	24
Other softwoods	82	--	--	50	32
Total	169,942	93,268	73,651	2,766	257
HARDWOODS					
Select white oak	11,856	10	1,729	7,494	2,623
Select red oak	25,721	160	4,587	20,026	948
Other red oak	1,061	--	10	1,010	41
Hickory	274	--	9	252	13
Yellow birch	41	14	17	10	--
Hard maple	3,297	39	676	2,103	479
Soft maple	5,992	69	558	4,971	394
Ash	10,247	683	3,353	4,861	1,350
Balsam poplar	4,508	1,165	2,522	603	218
Paper birch	13,865	6,582	6,257	1,012	14
Bigtooth aspen	8,797	1,472	5,473	1,852	--
Quaking aspen	163,733	73,787	76,701	12,708	537
Basswood	10,162	152	2,768	5,353	1,889
Elm	21,143	618	4,073	11,371	5,081
Select hardwoods	374	--	--	298	76
Other hardwoods	9,294	7	22	5,312	3,953
Noncommercial species	--	--	--	--	--
Total	290,365	84,758	108,755	79,236	17,616
All species	460,307	178,026	182,406	82,002	17,873

[1]/Removals in 1976 are trend-level removals. "Other" removals from the transfer of commercial forest land to productive-reserved are not included in 1976 removals.

[2]/International 1/4-inch rule.

Table 36.--Net annual growth and removals[1/] of growing stock on commercial forest land by species group, Minnesota, 1976

(In thousand cubic feet)

Species	Net annual growth	Annual timber removals
SOFTWOODS		
White pine	5,599	2,910
Red pine	15,684	4,177
Jack pine	25,677	21,470
White spruce	10,701	4,188
Black spruce	16,520	13,755
Balsam fir	31,902	13,893
Tamarack	2,269	4,982
Northern white-cedar	11,274	3,315
Other softwoods	155	110
Total	119,781	68,800
HARDWOODS		
Select white oak	8,733	5,119
Select red oak	15,691	9,779
Other red oak	256	323
Hickory	455	198
Yellow birch	118	16
Hard maple	8,660	1,388
Soft maple	6,454	2,840
Ash	9,468	5,063
Balsam poplar	17,757	3,078
Paper birch	30,290	9,113
Bigtooth aspen	1,086	3,444
Quaking aspen	93,083	69,535
Basswood	17,252	3,529
Elm	18,022	7,813
Select hardwoods	440	66
Other hardwoods	1,374	3,496
Noncommercial species	--	--
Total	229,139	124,800
All species	348,920	193,600

[1/]Removals in 1976 are trend-level removals. "Other" removals from the transfer of commercial forest land to productive-reserved are not included in 1976 removals.

Table 37.--Net annual growth and removals[1/] of sawtimber on commercial forest land by species group, Minnesota, 1976

(In thousand board feet)[2/]

Species	Net annual growth	Annual timber removals
SOFTWOODS		
White pine	33,304	13,190
Red pine	74,768	15,214
Jack pine	88,650	56,934
White spruce	36,750	12,679
Black spruce	18,568	26,130
Balsam fir	86,053	27,000
Tamarack	8,460	10,165
Northern white-cedar	33,003	8,548
Other softwoods	763	82
Total	380,319	169,942
HARDWOODS		
Select white oak	30,845	11,856
Select red oak	61,191	25,721
Other red oak	960	1,061
Hickory	1,484	274
Yellow birch	612	41
Hard maple	30,649	3,297
Soft maple	18,380	5,992
Ash	18,003	10,247
Balsam poplar	51,922	4,508
Paper birch	53,434	13,865
Bigtooth aspen	11,116	8,797
Quaking aspen	330,071	163,733
Basswood	48,788	10,162
Elm	61,699	21,143
Select hardwoods	2,261	374
Other hardwoods	9,730	9,294
Noncommercial species	--	--
Total	731,145	290,365
All species	1,111,464	460,307

[1/]Removals in 1976 are trend-level removals. "Other" removals from the transfer of commercial forest land to productive-reserved are not included in 1976 removals.

[2/]International 1/4-inch rule.

Table 38.--Net annual growth and removals[1/] of growing stock on commercial forest land by ownership class and softwoods and hardwoods, Minnesota, 1976

(In thousand cubic feet)

Owner	Net annual growth			Annual timber removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
FEDERAL						
National Forest	50,903	25,111	25,792	16,423	7,946	8,477
Other federal	18,686	7,048	11,638	5,202	2,686	2,516
Subtotal	69,589	32,159	37,430	21,625	10,632	10,993
STATE						
Total	63,052	25,862	37,190	34,123	18,920	15,203
COUNTY & MUNICIPAL						
Total	54,203	23,653	30,550	18,354	5,753	12,601
PRIVATE						
Forest industry	15,899	8,872	7,027	15,165	7,491	7,674
Farm and other	146,177	29,235	116,942	104,333	26,004	78,329
Subtotal	162,076	38,107	123,969	119,498	33,495	86,003
ALL OWNERS						
Total	348,920	119,781	229,139	193,600	68,800	124,800

1/Removals in 1976 are trend-level removals. "Other" removals from the transfer of commercial forest land to productive-reserved are not included in 1976 removals.

Table 39.--Net annual growth and removals[1/] of sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Minnesota, 1976

(In thousand board feet)[2/]

Owner	Net annual growth			Annual timber removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
FEDERAL						
National Forest	208,935	117,477	91,458	41,631	21,862	19,769
Other federal	45,034	15,357	29,677	12,926	6,839	6,087
Subtotal	253,969	132,834	121,135	54,557	28,701	25,856
STATE						
Total	151,118	58,859	92,259	90,134	52,004	38,130
COUNTY & MUNICIPAL						
Total	182,828	66,220	116,608	46,436	14,769	31,667
PRIVATE						
Forest industry	60,338	27,906	32,432	34,606	16,845	17,761
Farmer and other	463,211	94,500	368,711	234,574	57,623	176,951
Subtotal	523,549	122,406	401,143	269,180	74,468	194,712
ALL OWNERS						
Total	1,111,464	380,319	731,145	460,307	169,942	290,365

1/Removals in 1976 are trend-level removals. "Other" removals from the transfer of commercial forest land to productive-reserved are not included in 1976 removals.

2/International 1/4-inch rule.

Table 40.--Annual mortality of growing stock and sawtimber on commercial forest land by species group, Minnesota, 1976

Species	Growing stock	Sawtimber
	Thousand cubic feet	Thousand board feet[1]/
SOFTWOODS		
White pine	960	2,994
Red pine	110	345
Jack pine	3,322	6,009
White spruce	1,102	3,408
Black spruce	3,899	1,513
Balsam fir	16,774	21,233
Tamarack	5,857	8,748
Northern white-cedar	1,704	6,212
Other	--	--
Total	33,728	50,462
HARDWOODS		
Select white oak	1,098	3,444
Select red oak	2,993	10,815
Other red oak	--	--
Hickory	--	--
Yellow birch	87	27
Hard maple	1,122	1,003
Soft maple	252	914
Ash	5,071	11,195
Balsam poplar	10,723	17,656
Paper birch	4,870	7,231
Bigtooth aspen	4,841	7,153
Quaking aspen	66,519	110,093
Basswood	1,410	5,043
Elm	8,125	37,957
Select hardwoods	223	--
Other hardwoods	479	--
Noncommercial species	--	--
Total	107,813	212,531
All species	141,541	262,993

[1]/International 1/4-inch rule.

Table 41.--Annual mortality of growing stock on commercial forest land by species group and cause Minnesota, 1976

(In thousand cubic feet)

Species	All causes	Cause									
		Insects	Disease	Fire	Animals	Weather	Suppression	Logging	Timber stand improvement	Land clearing	Unknown and other
SOFTWOODS											
White pine	960	--	762	109	27	27	--	--	--	--	35
Red pine	110	--	--	--	--	59	--	13	--	--	38
Jack pine	3,322	70	1,862	396	143	353	--	12	--	--	486
White spruce	1,102	101	700	--	26	261	--	--	--	--	14
Black spruce	3,899	173	2,390	--	106	618	--	--	--	--	612
Balsam fir	16,774	5,198	6,775	--	76	2,064	19	51	--	45	2,546
Tamarack	5,857	533	1,570	--	86	677	--	--	--	--	2,991
Northern white-cedar	1,704	--	482	--	--	641	--	56	--	--	525
Other softwoods	--	--	--	--	--	--	--	--	--	--	--
Total	33,728	6,075	14,541	505	464	4,700	19	132	--	45	7,247
HARDWOODS											
Select white oak	1,098	--	756	--	--	342	--	--	--	--	--
Select red oak	2,993	--	1,039	--	--	1,032	--	214	--	--	708
Other red oak	--	--	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--	--	--
Yellow birch	87	--	87	--	--	--	--	--	--	--	--
Hard maple	1,122	--	858	--	--	--	--	--	264	--	--
Soft maple	252	--	71	--	--	181	--	--	--	--	--
Ash	5,071	--	1,350	159	--	2,437	--	--	310	--	815
Balsam poplar	10,723	--	5,623	84	784	2,595	--	--	--	--	1,637
Paper birch	4,870	80	3,431	120	--	428	--	53	--	--	758
Bigtooth aspen	4,841	--	2,728	--	--	341	--	--	--	--	1,772
Quaking aspen	66,519	612	42,490	6,817	2,259	10,641	--	277	--	--	3,423
Basswood	1,410	--	232	--	--	959	--	104	--	--	115
Elm	8,125	--	7,446	--	--	--	--	7	129	--	543
Select hardwoods	223	--	223	--	--	--	--	--	--	--	--
Other hardwoods	479	--	--	--	--	207	--	--	--	--	272
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--
Total	107,813	692	66,334	7,180	3,043	19,163	--	655	703	--	10,043
All species	141,541	6,767	80,875	7,685	3,507	23,863	19	787	703	45	17,290

Table 42.--Annual mortality of sawtimber on commercial forest land by species group and cause, Minnesota, 1976

(In thousand board feet)[1/]

Species	All causes	Cause									
		Insects	Disease	Fire	Animals	Weather	Suppression	Logging	Timber stand improvement	Land clearing	Unknown and other
SOFTWOODS											
White pine	2,994	--	1,786	682	193	171	--	--	--	--	162
Red pine	345	--	--	--	--	157	--	--	--	--	188
Jack pine	6,009	344	3,195	421	390	620	--	70	--	--	969
White spruce	3,408	237	1,710	--	60	1,401	--	--	--	--	--
Black spruce	1,513	--	721	--	228	464	--	--	--	--	100
Balsam fir	21,233	7,386	5,302	--	112	3,932	--	143	--	--	4,358
Tamarack	8,748	--	4,372	--	--	--	--	--	--	--	4,376
Northern white-cedar	6,212	--	1,589	--	--	2,434	--	376	--	--	1,813
Other softwoods	--	--	--	--	--	--	--	--	--	--	--
Total	50,462	7,967	18,675	1,103	983	9,179	--	589	--	--	11,966
HARDWOODS											
Select white oak	3,444	--	1,624	--	--	1,820	--	--	--	--	--
Select red oak	10,815	--	4,890	--	--	4,824	--	--	--	--	1,101
Other red oak	--	--	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--	--	--
Yellow birch	27	--	27	--	--	--	--	--	--	--	--
Hard maple	1,003	--	1,003	--	--	--	--	--	--	--	--
Soft maple	914	--	8	--	--	906	--	--	--	--	--
Ash	11,195	--	1,469	--	--	8,210	--	--	1,516	--	--
Balsam poplar	17,656	--	9,720	--	--	6,218	--	--	--	--	1,718
Paper birch	7,231	--	4,582	--	--	766	--	293	--	--	1,590
Bigtooth aspen	7,153	--	5,520	--	--	1,633	--	--	--	--	--
Quaking aspen	110,093	--	62,723	8,293	5,410	26,728	--	1,171	--	--	5,768
Basswood	5,043	--	885	--	--	4,158	--	--	--	--	--
Elm	37,957	--	37,437	--	--	--	--	--	520	--	--
Select hardwoods	--	--	--	--	--	--	--	--	--	--	--
Other hardwoods	--	--	--	--	--	--	--	--	--	--	--
Noncommercial species	--	--	--	--	--	--	--	--	--	--	--
Total	212,531	--	129,888	8,293	5,410	55,263	--	1,464	2,036	--	10,177
All species	262,993	7,967	148,563	9,396	6,393	64,442	--	2,053	2,036	--	22,143

[1/] International 1/4-inch rule.

Table 43.--Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Minnesota, 1976

Owner	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			[1]/Thousand board feet		
National Forest	14,272	7,505	6,767	9,352	2,426	6,926
Bureau of Land Management	--	--	--	--	--	--
Indian	4,029	1,019	3,010	7,303	1,994	5,309
Miscellaneous federal	861	131	730	1,914	388	1,526
State	20,998	8,772	12,226	35,131	12,350	22,781
County and municipal	31,990	4,477	27,513	51,818	7,623	44,195
Forest industry	12,680	3,534	9,146	18,497	6,419	12,078
Farmer	36,797	4,312	32,485	94,273	10,728	83,545
Farmer owned-leased	--	--	--	--	--	--
Misc. private-corp.	6,213	1,543	4,670	16,586	3,994	12,592
Misc. private-indiv.	13,507	2,435	11,072	28,119	4,540	23,579
Misc. priv.-corp., leased	194	--	194	--	--	--
Misc. priv.-indiv., leased	--	--	--	--	--	--
1 owners	141,541	33,728	107,813	262,993	50,462	212,531

[1]/International 1/4-inch rule.

Table 44.--Output of timber products by source of material and softwoods and hardwoods, Minnesota, 1975

Product	Standard units	Total		Roundwood products				Plant byproducts	
				Growing stock		Nongrowing stock			
		No. of units	Thousand cubic feet	No. of units	Thousand cubic feet	No. of units	Thousand cubic feet	No. of units	Thousand cubic feet
PULPWOOD									
Softwood	1/Standard	622,245	49,148	546,506	43,165	31,779	2,510	43,960	3,473
Hardwood	cords	736,607	58,186	591,391	46,715	81,578	6,444	63,638	5,027
Total		1,358,852	107,334	1,137,897	89,880	113,357	8,954	107,598	8,500
FUELWOOD									
Softwood	1/Standard	40,966	2,828	7,551	511	9,677	655	23,738	1,662
Hardwood	cords	301,921	20,885	123,763	8,554	161,057	11,134	17,101	1,197
Total		342,887	23,713	131,314	9,065	170,734	11,789	40,839	2,859
POSTS									
Softwood	Thousand	2,360	1,896	1,921	1,544	439	352	--	--
Hardwood	pieces	421	403	270	255	151	148	--	--
Total		2,781	2,299	2,191	1,799	590	500	--	--
VENEER LOGS									
Softwood	2/Thousand	--	--	--	--	--	--	--	--
Hardwood	board feet	3,216	503	2,946	460	270	43	--	--
Total		3,216	503	2,946	460	270	43	--	--
POLES									
Softwood	Pieces	103,405	618	102,067	610	1,338	8	--	--
Hardwood		--	--	--	--	--	--	--	--
Total		103,405	618	102,067	610	1,338	8	--	--
SAW LOGS									
Softwood	2/Thousand	60,923	11,261	59,144	10,932	1,779	329	--	--
Hardwood	board feet	95,200	16,972	92,917	16,566	2,283	406	--	--
Total		156,123	28,233	152,061	27,498	4,062	735	--	--
OTHER 3/									
Softwood	Thousand	416	416	188	188	2	2	226	226
Hardwood	cubic feet	6,745	6,745	5,535	5,535	393	393	817	817
Total		7,161	7,161	5,723	5,723	395	395	1,043	1,043
ALL PRODUCTS									
Softwood	Thousand	66,167	66,167	56,950	56,950	3,856	3,856	5,361	5,361
Hardwood	cubic feet	103,694	103,694	78,085	78,085	18,568	18,568	7,041	7,041
Total		169,861	169,861	135,035	135,035	22,424	22,424	12,402	12,402

1/Rough-wood, 128 cubic foot basis.

2/International 1/4-inch rule.

3/Other (industrial production) includes match bolts, shaving bolts, particle bolts, lath bolts, piling, etc.

Table 45.--Output of roundwood products by source and softwoods and hardwoods, Minnesota, 1975

(In thousand cubic feet)

luct and ies group	All sources	Growing-stock trees			Rough and rotten trees	Salvable dead trees	Other sources
		Total	Sawtimber	Poletimber			
RIAL PRODUCTS							
logs							
oftwood	11,261	10,932	10,659	273	10	--	319
ardwood	16,972	16,566	14,519	2,047	188	--	218
Subtotal	28,233	27,498	25,178	2,320	198	--	537
er logs and bolts							
oftwood	--	--	--	--	--	--	--
ardwood	503	460	460	--	43	--	--
Subtotal	503	460	460	--	43	--	--
wood							
oftwood	45,675	43,165	27,609	15,556	446	37	2,027
ardwood	53,159	46,715	26,549	20,166	4,600	983	861
Subtotal	98,834	89,880	54,158	35,722	5,046	1,020	2,888
erage							
oftwood	--	--	--	--	--	--	--
ardwood	128	110	110	--	11	--	7
Subtotal	128	110	110	--	11	--	7
ing							
oftwood	86	86	74	12	--	--	--
ardwood	--	--	--	--	--	--	--
Subtotal	86	86	74	12	--	--	--
es							
oftwood	618	610	570	40	8	--	--
ardwood	--	--	--	--	--	--	--
Subtotal	618	610	570	40	8	--	--
e timbers (Round)							
oftwood	--	--	--	--	--	--	--
ardwood	--	--	--	--	--	--	--
Subtotal	--	--	--	--	--	--	--
es (Round and split)							
oftwood	1,896	1,544	347	1,197	233	59	60
ardwood	403	255	113	142	74	--	74
Subtotal	2,299	1,799	460	1,339	307	59	134
er							
oftwood	104	102	92	10	--	--	2
ardwood	5,800	5,425	4,222	1,203	230	51	94
Subtotal	5,904	5,527	4,314	1,213	230	51	96
industrial products							
oftwood	59,640	56,439	39,351	17,088	697	96	2,408
ardwood	76,965	69,531	45,973	23,558	5,146	1,034	1,254
al	136,605	125,970	85,324	40,646	5,843	1,130	3,662
OOD							
oftwood	1,166	511	166	345	45	63	547
ardwood	19,688	8,554	2,786	5,768	831	1,137	9,166
al	20,854	9,065	2,952	6,113	876	1,200	9,713
PODUCTS							
wood	60,806	56,950	39,517	17,433	742	159	2,955
dwood	96,653	78,085	48,759	29,326	5,977	2,171	10,420
	157,459	135,035	88,276	46,759	6,719	2,330	13,375

Table 46.--Forest products harvested by ownership class and product, Minnesota, 1975

Ownership class	Pulpwood	Saw logs	Fuelwood	Posts	Poles	Other
	[1/] Cords	[2/] Thousand board feet	[1/] Cords	Thousand pieces	Pieces	Thousand cubic feet
FEDERAL						
National Forest						
Softwood	78,181	9,212	3,439	--	700	27
Hardwood	70,625	3,684	34,096	--	--	1,004
Subtotal	148,806	12,896	37,535	--	700	1,031
Other federal						
Softwood	24,320	2,538	165	108	4,700	3
Hardwood	15,887	2,972	1,995	--	--	38
Subtotal	40,207	5,510	2,160	108	4,700	41
Total	189,013	18,406	39,695	108	5,400	1,072
STATE						
Softwood	172,785	23,420	710	715	29,142	33
Hardwood	122,153	17,275	7,001	2	--	508
Total	294,938	40,695	7,711	717	29,142	541
COUNTY						
Softwood	55,850	5,235	661	80	485	13
Hardwood	122,470	9,608	8,713	--	--	1,016
Total	178,320	14,843	9,374	80	485	1,029
PRIVATE						
Forest industry						
Softwood	86,840	2,581	153	341	--	16
Hardwood	85,748	3,192	499	--	--	350
Subtotal	172,588	5,773	652	341	--	366
Farm and other						
Softwood	160,309	17,937	12,100	1,116	68,378	98
Hardwood	256,086	58,469	232,516	419	--	3,515
Subtotal	416,395	76,406	244,616	1,535	68,378	3,613
Total	588,983	82,179	245,268	1,876	68,378	3,979
ALL OWNERS						
Softwood	578,285	60,923	17,228	2,360	103,405	190
Hardwood	672,969	95,200	284,820	421	--	6,431
Total	1,251,254	156,123	302,048	2,781	103,405	6,621

[1/] Rough-wood, 128 cubic foot basis.

[2/] International 1/4-inch rule.

Table 47.--Timber products from roundwood by species group and product, Minnesota, 1975

Species	All Products	Saw logs		Veneer logs		Pulpwood	
	[1]/Thousand cubic feet	[2]/Thousand board feet	[1]/Thousand cubic feet	[2]/Thousand board feet	[1]/Thousand cubic feet	Thousand cords	[1]/Thousand cubic feet
SOFTWOODS							
White pine	2,541	11,272	1,943	--	--	7,386	584
Red pine	3,519	10,680	1,840	--	--	10,790	850
Jack pine	21,922	29,058	5,579	--	--	180,543	14,260
Spruce	16566	3,145	605	--	--	202,004	15,956
Balsam fir	10,073	2,100	400	--	--	121,296	9,583
Tamarack	4,620	79	14	--	--	56,266	4,442
Northern white-cedar	1,565	4,589	880	--	--	--	--
Total	60,806	60,923	11,261	--	--	578,285	45,675
HARDWOODS							
White oak	2,498	4,187	695	29	3	--	--
Red oak	7,917	14,355	2,404	751	118	9,703	769
Hickory	29	78	13	--	--	--	--
Yellow birch	23	--	--	20	3	3	--
Hard maple	747	934	153	290	45	200	13
Soft maple	546	781	130	168	25	79	3
Ash	2,639	3,954	683	17	2	55	5
Balsam poplar	1,210	1,269	222	--	--	10,725	848
Paper birch	8,294	2,728	473	190	29	35,474	2,804
Aspen	66,831	49,501	9,166	443	72	615,995	48,660
Basswood	1,042	4,369	758	417	66	--	--
Elm	3,810	9,508	1,665	376	59	733	57
Black walnut	61	236	37	151	24	--	--
Cottonwood	778	3,196	556	358	56	--	--
Other hardwoods	228	104	17	6	1	2	--
Total	96,653	95,200	16,972	3,216	503	672,969	53,159
All species	157,459	156,123	28,233	3,216	503	1,251,254	98,834

(Table 47 continued on next page)

[1]/Small quantities may round off to less than 500 cubic feet and will be shown as a dash in columns showing thousand cubic feet.

[2]/International 1/4-inch rule.

(Table 47 continued)

Species	Fuelwood		Poles		Posts		Other Products
	Cords	1/ Thousand cubic feet	Pieces	1/ Thousand cubic feet	Thousand pieces	1/ Thousand cubic feet	1/ Thousand cubic feet
SOFTWOODS							
White pine	360	14	--	--	--	--	--
Red pine	519	27	57,284	343	523	419	40
Jack pine	12,353	865	46,121	275	1110	893	50
Spruce	125	5	--	--	--	--	--
Balsam fir	1,338	90	--	--	--	--	--
Tamarack	1,919	126	--	--	49	38	--
Northern white-cedar	614	39	--	--	678	546	100
Total	17,228	1,166	103,405	618	2,360	1,896	190
HARDWOODS							
White oak	21,759	1,509	--	--	233	231	60
Red oak	63,515	4,436	--	--	139	140	50
Hickory	410	16	--	--	--	--	--
Yellow birch	364	20	--	--	--	--	--
Hard maple	7,820	521	--	--	--	--	15
Soft maple	5,805	388	--	--	--	--	--
Ash	28,206	1,945	--	--	11	4	--
Balsam poplar	2,101	140	--	--	3	--	--
Paper birch	61,335	4,276	--	--	--	--	712
Aspen	56,326	3,937	--	--	35	28	4,968
Basswood	2,652	149	--	--	--	--	69
Elm	28,280	1,975	--	--	--	--	54
Black walnut	--	--	--	--	--	--	--
Cottonwood	2,811	166	--	--	--	--	--
Other hardwoods	3,436	210	--	--	--	--	--
Total	284,820	19,688	--	--	421	403	5,928
All species	302,048	20,854	103,405	618	2,781	2,299	6,118

Table 48.--Volume of primary plant residue by kind of material and type of use, Minnesota, 1975

(In thousand cubic feet)

Type of use	Kind of wood residue							
	Total		Coarse[1/]		Fine[2/]		Bark[3/]	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
ber products[4/]	1,127.1	2,968.2	1,015.1	2,797.1	112.0	171.1	--	76.6
arcoal	57.6	216.2	57.6	216.2	--	--	35.9	100.2
dustrial fuel	1,292.9	161.4	800.7	28.1	492.2	133.3	694.1	404.5
mestic fuel	368.4	1,034.9	354.4	851.5	14.0	183.4	167.8	423.5
scellaneous[5/]	167.9	600.9	89.7	51.1	78.2	549.8	14.0	459.2
t used[6/]	1,430.0	2,155.8	494.0	508.1	936.0	1,647.7	1,109.7	2,136.1
Total	4,443.9	7,137.4	2,811.5	4,452.1	1,632.4	2,685.3	2,021.5	3,600.1

[1/] Suitable for chipping such as slabs, edgings, veneer cores, etc.

[2/] Not suitable for chipping such as sawdust, veneer clippings, etc.

[3/] Does not include bark disposal at pulpmills.

[4/] For manufacture of pulp, hardboard, or roofing felt.

[5/] Livestock bedding, mulch, small dimension, and specialty items.

[6/] Includes residue burned as waste.

Table 49.--Removals,[1/] net annual growth, and inventory of growing stock on commercial forest land, Minnesota, 1977, and low removals option projections[2/] to 2007

(In million cubic feet)

Year	Removals			Growth			Inventory		
	All species	Soft-woods	Hard-woods	All species	Soft-woods	Hard-woods	All species	Soft-woods	Hard-woods
1977	198.4	70.7	127.7	348.9	119.8	229.1	11,454.0	3,477.0	7,977.0
1987	251.8	91.7	160.1	431.7	128.6	303.1	13,229.6	3,923.0	9,306.6
1997	307.6	112.8	194.8	415.7	126.4	289.3	14,698.0	4,174.7	10,523.3
2007	359.8	127.5	232.3	375.3	121.5	253.8	15,287.2	4,205.3	11,081.9

[1/] Timber removals includes volume "lost" due to land clearing, flooding, thinning, or changes in land use, in addition to timber cut and used.

[2/] Based on the following assumptions: (a) that the overall removals rate will be lower than that for the high removals option; (b) that annual removals rates will differ for each timber product, but that timber removals will increase at an average annual rate of 2.678 percent or 1,893 thousand cubic feet for softwoods and at an average annual rate of 2.730 percent or 3,487 thousand cubic feet for hardwoods; (c) that the total area of commercial forest land will decline at an annual rate of 0.310 percent; (d) that radial growth will decline over time in relation to the increase of basal area per acre of trees; (e) that the intensity of forest management practiced will continue at the rate indicated by recent trends; (f) that the volume of "other" removals will drop during the period as more of these trees are utilized for products.

Table 50.--Removals[1] net annual growth, and inventory of growing stock on commercial forest land, Minnesota, 1977, and high removals option projections[2] to 2007

(In million cubic feet)

Year	Removals			Growth			Inventory		
	All species	Soft-woods	Hard-woods	All species	Soft-woods	Hard-woods	All species	Soft-woods	Hard-woods
1977	199.1	71.1	128.0	348.9	119.8	229.1	11,454.0	3,477.0	7,977.0
1987	270.3	98.5	171.8	432.1	128.5	303.6	13,148.8	3,889.8	9,259.0
1997	371.6	132.9	238.7	422.0	126.7	295.3	14,237.4	4,006.8	10,230.6
2007	485.7	166.1	319.6	392.7	122.8	269.9	13,995.4	3,750.2	10,245.2

[1]Timber removals includes volume "lost" due to land clearing, flooding, thinning, or changes in land use, in addition to timber cut and used.

[2]Based on the following assumptions: (a) that the overall removals rate will be higher than that for the low removals option; (b) that annual removals rates will differ for each timber product, but that timber removals will increase at an average annual rate of 4.454 percent or 3,167 thousand cubic feet for softwoods and at an average annual rate of 4.490 percent or 6,387 thousand cubic feet for hardwoods; (c) that the total area of commercial forest land will decline at an annual rate of 0.310 percent; (d) that radial growth will decline over time in relation to the increase of basal area per acre of trees; (e) that the intensity of forest management practiced will continue at the rate indicated by recent trends; (f) that the volume of "other" removals will drop during the period as more of these trees are utilized for products.

Table 51.--Sampling errors[1] for estimates smaller than the State totals of volume, net growth, removals, and area of commercial forest land, Minnesota, 1977

Sampling error	Commercial forest area	Growing Stock			Sawtimber		
		Inventory	Growth	Removals	Inventory	Growth	Removals
Percent	Thousand acres	Million cubic feet			[2]Million board feet		
1	2,131.6	12,460.9	705.6	5,500.0	84,456.1	3,312.4	8,750.1
2	532.9	3,115.2	176.4	1,375.0	21,114.0	828.1	2,187.5
3	237.2	1,385.3	78.4	611.0	9,382.0	368.5	972.2
4	133.2	779.7	44.1	343.7	5,280.8	207.0	546.9
5	85.3	498.4	28.2	220.0	3,378.2	132.5	350.0
10	21.3	124.6	7.1	55.0	844.6	33.1	87.5
15	9.4	55.2	3.1	24.4	375.8	14.6	38.9
20	5.3	31.3	1.8	13.7	211.6	8.3	21.9
25	3.4	19.9	1.2	8.8	135.4	5.3	14.0
50	0.8	5.0	0.3	2.2	33.9	1.3	3.5
100	0.2	1.2	0.1	0.5	8.5	0.3	0.9

[1]At the 68-percent probability level.

[2]International 1/4-inch rule.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1982-565-836/192

Spencer, John S., Jr.

1982. The fourth Minnesota forest inventory: timber volumes and projections of timber supply. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-57, 72 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

The fourth inventory of Minnesota's forest resources shows a 21-percent increase in growing-stock volume between 1962 and 1977, from 9.4 to 11.5 billion cubic feet. Presented are text and statistics on timber volume, growth, mortality, removals, and future timber supply.

KEY WORDS: Timber resource, statistics, growth, removals, mortality.

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A Second Look at North Dakota's Timber Land

Pamela J. Jakes and W. Brad Smith

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This report includes the most commonly used Resources Evaluation statistics, but other forest resource data can also be provided. Persons requesting additional information from the raw inventory data are expected to pay the retrieval costs. These costs will vary depending on the complexity of the request, from less than $100.00 for a simple request to $2,000.00 for a complex retrieval involving the services of a Resources Evaluation computer programmer. Requests for data will be scheduled to minimize the impact on the Resources Evaluation work unit.

Requests for unpublished information may be directed to:

Burton L. Essex
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North Central Forest Experiment Station
1992 Folwell Avenue
St. Paul, Minnesota 55108

Phone: (612) 642-5282

Area served: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, eastern South Dakota, Wisconsin

North Central Forest Experiment Station
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1992 Folwell Avenue
St. Paul, Minnesota 55108
Manuscript approved for publication April 5, 1981

1982

FOREWORD

Resources Evaluation is a continuing endeavor as mandated by the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA). Its objective is to periodically inventory the Nation's forest land to determine the extent, condition, and volume of timber, growth, and depletions. This kind of up-to-date information is essential for intelligent forest policies and programs. USDA Forest Service regional experiment stations are responsible for conducting these inventories and publishing summary reports for individual States. The North Central Forest Experiment Station is responsible for Resources Evaluation work in Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, eastern South Dakota, and Wisconsin.

The second North Dakota Forest Inventory was directed by Burton Essex, Resources Evaluation Project Leader. Mark Hansen, Gerhard Raile, and Brad Smith of the Project's Techniques Group, and Project Leader Essex were responsible for inventory design and sample selection. Data processing and generation of summary tables were handled by the Techniques Group. Arnold J. Ostrom supervised the aerial-photo and data collection, with support from Dale Krueger and Tom Castonguay in the St. Paul office and Roger Jensen in the field. Aerial photos were supplied by the USDA Agricultural Stabilization and Conservation Service. James Blyth designed and supervised collection of timber product output and timber removals data, with assistance from Walter Pasicznyk, Deputy State Forester, North Dakota Forest Service. Pamela Jakes checked consistency of the second North Dakota Forest Inventory with the first and ran the 30-year projections of timber volume. Brad Smith evaluated treatment opportunities in the State.

Many State and Federal employees provided background information for the analysis of North Dakota's second Forest Inventory, including Samuel Becker, State and Private Forestry, USDA Forest Service; Robert Morgan, North Dakota Game and Fish Department; Glenn Roloff, USDA Forest Service; and John Van Ells, North Dakota Forest Service. Mary Jean Hanson, Patrick Peine, and Jean Smoley helped prepare the State tables and manuscript.

Aerial photo interpretation began in June 1978 and was completed in July 1979. The Bureau of Indian Affairs conducted preliminary field checks in 1978. Between June and November 1979, crews from the North Central Station conducted their fieldwork. The report on the previous survey was dated 1954. Computer updates were made for RPA for the years 1962, 1970, and 1977.

HIGHLIGHTS

Area

- One percent of North Dakota's land area is forest land.
- There are 985,700 acres of nonforest land with trees in the State, nearly half in improved pasture.
- The 343,200 acres of commercial forest land reported in the State in 1980 is 14 percent less than that found in 1954.
- The aspen forest type accounts for 41 percent of the commercial forest area.
- Farmers own more than three-fourths of the commercial forest land.

Inventory

- There is an average of 474 trees per acre of commercial forest land in the State.
- Cubic-foot volume in all live trees on commercial forest land totals 302.1 million cubic feet — 207.1 million cubic feet in growing-stock trees, 89.0 million cubic feet in cull trees, and 6.0 million cubic feet in salvable dead trees.
- Thirty-nine percent of the growing-stock volume is found in the aspen forest type; sawtimber volume is concentrated in the elm-ash forest type.
- On average, there are 603 cubic feet of growing stock per acre of forest land.
- Growing-stock volume on nonforest land with trees totals 419.4 million cubic feet.

Stand Conditions

- The majority of the commercial forest land is in stands less than 51 years old.
- On average, a fully stocked natural stand will produce 48 cubic feet of growth per acre per year at culmination of mean annual increment.
- The average site index in the State is 53.
- Net annual growth of growing stock is 7.7 million cubic feet, or 22 cubic feet per acre.
- Average annual growing-stock removals are 1.5 million cubic feet — 77 percent goes to other removals, 22 percent to roundwood products, and 1 percent to logging residue.
- Average annual growing-stock removals are only 20 percent of growth.
- Growing-stock mortality is 1.6 million cubic feet.
- Disease is the primary cause of mortality.

Thirty-Year Projections

- The low removals option shows growing-stock removals increasing from 1.5 million cubic feet in 1979 to 4.4 million in 2010; inventory increases from 207.0 million cubic feet in 1980 to 476.2 million in 2010.
- The high removals option shows growing-stock removals increasing from 1.5 million cubic feet in 1979 to 10.0 million in 2010; inventory increases from 207.0 million cubic feet in 1980 to 435.6 million in 2010.

Treatment Opportunities

- Of the commercial forest land, 176,000 acres were targeted for treatment during the decade 1980-1989.
- The most common treatment is harvest, for which 135,400 acres qualify.
- The 12,900 acres qualifying for thinning are concentrated in the elm-ash forest type.
- Of the 27,700 acres of commercial forest land qualifying for stand conversion or restocking, 17,200 acres are in the elm-ash forest type.

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A SECOND LOOK AT NORTH DAKOTA'S TIMBER LAND, 1980

Pamela J. Jakes
Associate Resource Analyst
and **W. Brad Smith**
Associate Mensurationist

TIMBER RESOURCE TRENDS

The prairies of North Dakota are best known for heir capacity to produce abundant crops of wheat and arley. The scattered woodlands are not a dominant eature of the landscape, but they are very important. t the time of pioneer settlement in the mid 1800's, the atural woodlands of North Dakota covered about 00,000 acres. Today, there are 518,100 acres of land lassified as forest. Land clearing for agriculture has een the dominant force in the decline. Even from the arliest settlers, however, North Dakotans have realzed the value of trees for protecting their homes, crops, nd livestock. Currently there are more than 384,400 cres of protective shelterbelts, windbreaks, and woodd strips in the State. Data were collected in the recent North Dakota forest survey to determine the extent nd characteristics of these areas as well as the commercial forest resource.

Land Use in North Dakota and Trends in Land Use

Nonforest land occupies 99 percent of land

Resources Evaluation recognizes two primary categories of land use — forest and nonforest.[1] In North Dakota, only 1 percent of the total land area is forest and. Nonforest land accounts for 43.8 million acres of he total 44.3 million acres of land in the State (table 1). Two classes of nonforest land — cropland, and improved pasture and natural range — account for 93 ercent of the total nonforest area.

[1]*Terms are defined in alphabetical order in the ppendix, page 28.*

Table 1. — *Area by land class and Forest Survey Unit, North Dakota, 1980*

(In thousand acres)

Land class	All units	Eastern	Western
FOREST LAND			
Commercial	343.2	283.7	59.5
Unproductive	148.0	49.2	98.8
Reserved	26.9	1.9	25.0
Total	518.1	334.8	183.3
NONFOREST LAND			
Nonforest with trees:			
Cropland	44.6	34.7	9.9
Improved pasture and natural range[1]	436.6	44.6	392.0
Wooded strips[2]	167.0	47.0	120.0
Windbreaks[3]	30.1	23.4	6.7
Shelterbelts[4]	187.3	135.8	51.5
Other	120.1	22.5	100.6
Subtotal	985.7	308.0	677.7
Nonforest without trees:			
Cropland	30,545.8	18,065.4	12,480.4
Improved pasture and natural range[1]	10,121.1	2,259.9	7,861.2
Other	2,168.6	1,240.2	928.4
Subtotal	42,835.5	21,565.5	21,270.0
Total	43,821.2	21,873.5	21,947.7
Total land area[5]	44,339.3	22,208.3	22,131.0

[1]Contains land classified as range by the Soil Conservation Service.

[2]An acre or more of natural continuous forest land that would otherwise meet survey standards except it is less than 120 feet wide.

[3]Planted or natural stand of trees more than 120 feet wide or larger than 1 acre used for the protection of buildings.

[4]Planted stands of trees less than 120 feet wide or smaller than 1 acre or both.

[5]U.S. Department of Commerce, Bureau of Census. 1970. Area Measurement reports, GE 20, No. 1, 22 p.

The total agricultural area represented by cropland and improved pasture and natural range is evenly split between eastern and western North Dakota (fig. 1). The imbalance of cropland in the east is offset by the larger proportion of improved pasture and natural range in the west.

Nonforest land with trees has many uses

Because almost all land in North Dakota is nonforest, a closer look at nonforest land with trees is in order. This land class is important because it provides protection for buildings, crops, and livestock; reduces wind and water erosion; and provides stabilization for streambanks. Much of the area classified as nonforest land with trees could be classified as commercial forest land except that the primary land use excludes timber management or the area is too small. The largest portion of nonforest land with trees is improved pasture and natural range, found primarily in the western part of the State (fig. 2).

Protective areas such as shelterbelts and windbreaks are primarily found in the east; the narrower wooded strips dominate in the more arid western portions of the State. State and Federal agencies participate in programs such as the Agricultural Conservation Program and the Great Plains Conservation Program which help establish shelterbelts and windbreaks (fig. 3). As the result of such plantings, the acreage of protective areas has increased since the 1954 survey. Protection of homes, livestock, soil, roads, pastures, crops, and wildlife is the primary function of these plantings, although incidental wood production, particularly for fuel, is a valuable byproduct.

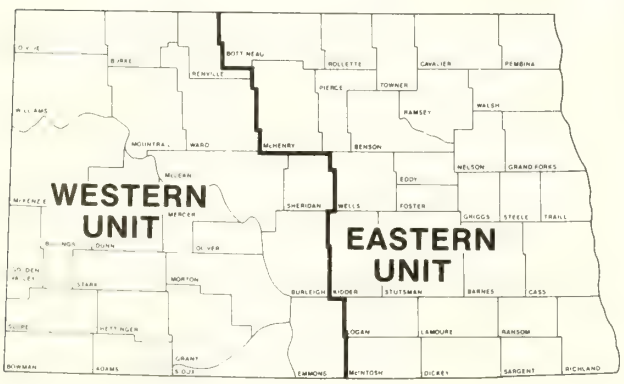


Figure 1. — *North Dakota Forest Survey Units, 1980.*

Figure 2. — *Improved pasture and natural r account for a large portion of the nonforest with trees.*

The dominant tree species used for protec plantings in North Dakota are elm, ash, willow, tonwood, spruce, juniper, and ponderosa pine. C mon tall shrub species are Russian olive, crabap

Figure 3. — *State and federal agencies participat programs that help establish windbreaks and s terbelts. (Photo courtesy of the North Dakota F est Service.)*

kecherry, and plum. Lower shrubs include Caraga- honeysuckle, lilac, and golden currant. Combina- ns of these trees and shrubs are often used. Al- ugh protective plantings are classified as nforest, they play an important role in North Dako- forestry. North Dakotans recognize that trees and ubs provide values far greater than their price as v materials for products of wood or fiber.

rest land declines between surveys

The area of forest land has declined 9 percent, from 2,000 acres in 1954 to 518,100 acres in 1980 (table 2). rest land is subdivided into three land classes — nmercial forest land, unproductive forest land, and erved forest land. Forest inventories concentrate collecting data on commercial forest land, because is the portion of the land base that can support iber production. Commercial forest land is the larg- class, accounting for 343,200 acres, or 66 percent of forest land area in the State. Most forest land urs in eastern North Dakota; five eastern Counties enson, Bottineau, Cavalier, Pembina, and Rolette) ve 41 percent of the State total. Three Counties in west (Billings, Dunn, and McKenzie) account for other 21 percent of the total.

Commercial forest land. — The 343,200 acres of nmercial forest land reported in 1980 is 55,200 es less than that reported in 1954 — an annual line of -0.5 percent. This downward trend in nmercial forest area is common throughout the airie States of Kansas, Nebraska, eastern South kota (east of the 103rd meridian), and North Dako- Clearing of land for agriculture is the primary se for the decline in commercial forest acreage in rth Dakota, but a large area has also been lost ause of dam construction and the subsequent oding of low-lying areas (fig. 4).

Noncommercial forest area. — The area of non- nmercial forest land remained relatively constant ring the 26 years between inventories. The 174,900 es of noncommercial forest land reported in 1980 is 00 acres more than that reported in 1954. Within noncommercial forest land class, the area of re- ved lands increased sharply from 3,200 acres in 54 to 26,900 acres in 1980, largely because of the nsfer of unproductive forest land to parks and idless areas. Unproductive forest land not in re- ved status declined 13 percent between surveys, m 170,400 acres to 148,000 acres.

---

[2]*Data for Prairie States other than North Dakota me from: USDA Forest Service. 1980. An analysis the timber situation in the United States, 1952- 30. Appendix 3.*

Table 2. — *Area by land use, North Dakota, adjusted 1954 and 1980*

(In thousand acres)

Land use	1954[1]	1980
FOREST		
Commercial	398.4	343.2
Noncommercial		
Unproductive	170.4	148.0
Reserved	3.2	26.9
Total	173.6	174.9
Total forest	572.0	518.1
NONFOREST	44,264.5	43,821.2
TOTAL LAND	44,836.5[2]	44,339.3[3]

[1]1954 data has been adjusted to be compatible with 1980 data due to change in inventory definitions and procedures.
[2]Census of Agriculture, 1950.
[3]Bureau of the Census, 1970.

Fifty-two percent of all noncommercial forest land in North Dakota is located in three western counties: Billings, Dunn, and McKenzie. Most of this land, classified as unproductive, is located in the Theodore Roosevelt National Park and the Little Missouri National Grassland.

Characteristics of North Dakota's Commercial Forest Land

Spotty distribution of commercial forest land

Fifty-five percent of all commercial forest land in North Dakota is concentrated in three areas — the Turtle Mountains (Bottineau and Rolette Counties), the Pembina Hills (Pembina and Cavalier Counties), and the Devils Lake area (Benson County). Another 30 percent is strung out along the bottoms of the Missouri, Red, and Sheyenne Rivers and their tributaries. The remaining area is in widely scattered patches across the State. Few counties in North Dakota have more than 1.0 percent of their land area classified as commercial forest and only one county (Rolette) exceeds 10 percent.

North Dakota's forest types

A forest type is a classification based on the species occupying the largest portion of an area of forest land. For example, commercial forest land classified as the aspen forest type is occupied primarily by aspen trees, but birch, balsam poplar, ash, and oak trees are also commonly found in the type.

Figure 4. — *Flooding resulting from dam construction eliminated more than 22,000 acres of commercial forest land between 1954 and 1980.*

Aspen forests dominate North Dakota's forest landscape, accounting for 41 percent of all commercial forest land (fig. 5). The type is concentrated in the Turtle Mountains and Pembina Hills where 103,100 of the 139,500 acres are found.

The second most dominant type in the State is elm-ash with 33 percent of all commercial forest land. This type is generally found in the low areas along rivers and streams.

The oak forest type accounts for 13 percent of t commercial forest area in the State. Bur oak, t principal species in this type, is indigenous to the dr ridges and southern slopes of the Pembina Hills a the Turtle Mountains, and to the area south of Dev Lake. These areas comprise 57 percent of all the o type found in North Dakota.

Cottonwood and Plains hardwoods (forests in whi basswood comprises a plurality of the stocking w

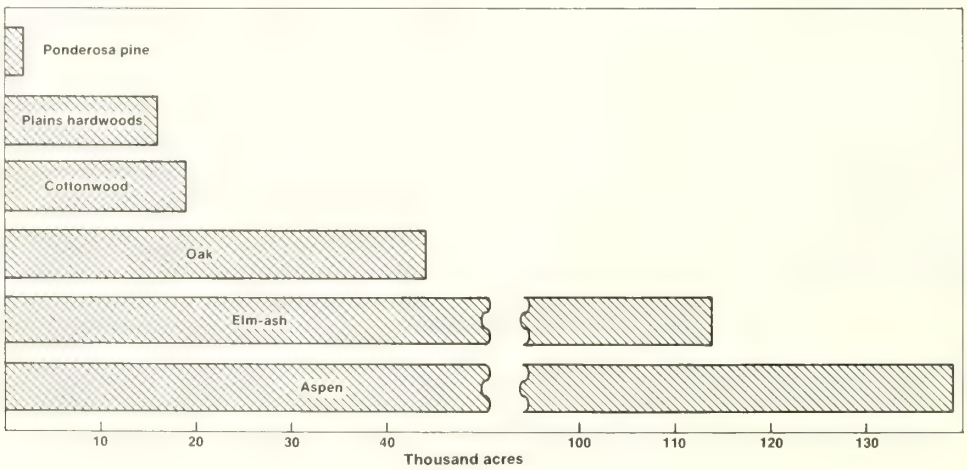


Figure 5. — *Area of commercial forest land by forest type, North Dakota, 1980. (Does not include 9,200 acres of nonstocked commercial forest land).*

n and oak as common associates) each comprise out 5 percent of the commercial forest area. The ttonwood type is found almost exclusively in the er bottom areas of western North Dakota, the ains hardwoods type is confined to the east, prima- y to the eastern Canadian border counties and the d River Valley.

Ponderosa pine, covering less than 1 percent of the mmercial forest land in North Dakota, is the only mmercial softwood type. It is found chiefly near the ttle Missouri River south of the Theodore Roosevelt ational Park. The largest concentration of this type a 2,000-acre area on the south bank of the Little issouri 10 miles north of Amidon. This area, once rt of the Dakota National Forest, was sold by the vernment in 1917 because of high administrative sts. Today, most of it is owned by private dividuals.

Rocky mountain juniper is found primarily in pure it noncommercial stands in the coulees and draws of e Badlands. Although juniper is not recognized as a rest type on commercial forest land in North Dako- , it is shown on the type map to indicate the concen- ated areas of these pure stands.

rgest area of commercial forest land in poletimber

The area of poletimber stands accounts for 44 per- nt of all commercial forest land, with most of the tal found in eastern North Dakota. Poletimber ands account for 47 percent of all commercial forest nd in the east, but seedling and sapling stands edominate in the western half of the State. Land ong reservoir areas is being regenerated (naturally d with help from the State's citizens), so much of e commercial forest land in the west is in seedling d sapling stands. Poletimber and seedling and sap- g stands are concentrated in the aspen forest type; e elm-ash type accounts for many of the sawtimber ands (fig. 6).

armers are the dominant land owners

Farmers own more than three-fourths of the State's mmercial forest land (fig. 7). Farmer-owned com- ercial forest land is predominately elm-ash and asp- forest types. Throughout the State, farmers own 92 rcent of the sawtimber stands, 71 percent of the letimber stands, and 69 percent of the seedling and pling stands. Nearly one-fourth of the commercial rest land owned by farmers is held by individuals ho own at least 100 acres of commercial forest land. rty percent of the farmer-owned commercial forest nd is owned by individuals with less than 5 acres. he size of the owner's holdings does not necessarily dicate the area of individual tracts of timber be- use one person may own several tracts.

Figure 6. — *Poletimber and sapling and seedling stands are concentrated in the aspen forest type. (Photo courtesy of the North Dakota Forest Service.)*

Private owners hold an additional 42,100 acres of commercial forest land, 80 percent of which is Indian land. The 39,500 acres of public commercial forest land is almost evenly divided between seedling and sapling stands (50 percent) and poletimber stands (44 percent). A few acres of State-owned land are in sawtimber stands.

Average stand age is 51 years

The majority of the commercial forest land in North Dakota is in stands less than 51 years old (fig. 8). The distribution of commercial forest land among stand-age classes varies by forest type. All aspen stands in the State are less than 81 years old, but more than 40 percent of the elm-ash stands are at least 81 years old. The oldest stands are found in the elm-ash, cottonwood, and Plains hardwoods forest types. Regeneration is occurring most frequently in the aspen and elm-ash forest types. Fifty-three percent of the sapling and seedling stands are in the aspen forest type and 36 percent are in elm-ash.

Site quality measures

Two measures of site quality were collected during the second North Dakota Forest Inventory. Site classes, expressed in cubic feet of growth per acre per year,

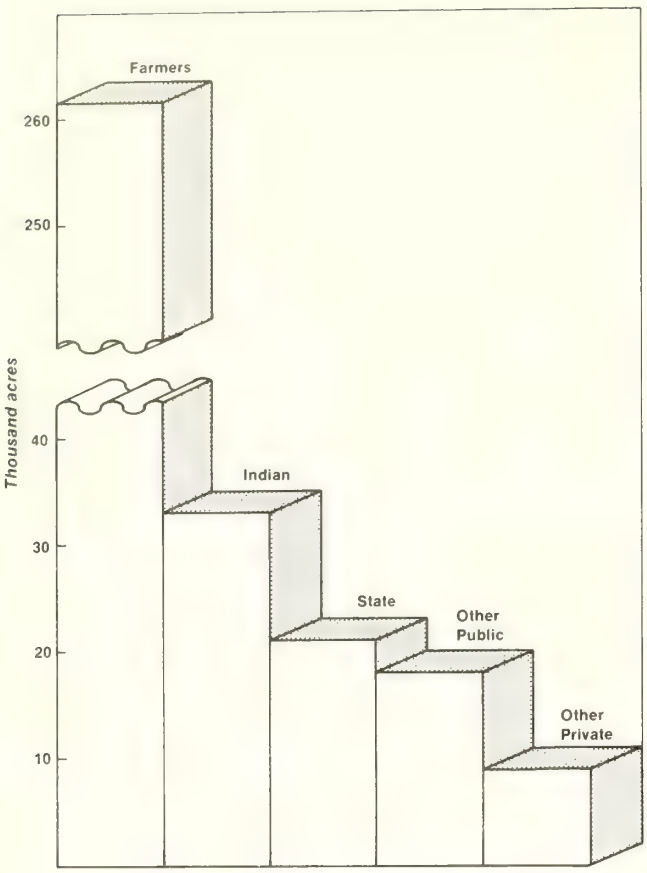


Figure 7. — *Area of commercial forest land by owner, North Dakota, 1980.*

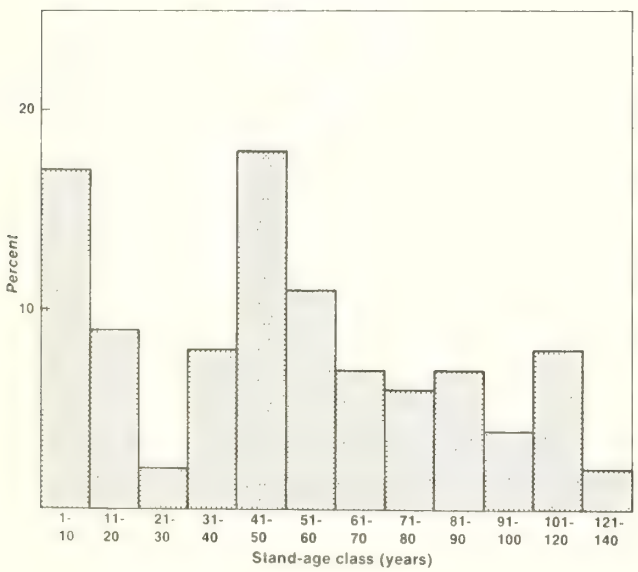


Figure 8. — *Distribution of commercial forest land by stand-age class, North Dakota, 1980.*

classify a site in terms of its inherent capacity to grow crops of industrial wood based on culmination of mean annual increment for fully stocked natural stands. On the average, a fully stocked stand in North Dakota will produce 48 cubic feet per acre per year at culmination of mean annual increment.

A second expression of site quality, site index, classifies sites in terms of the height of a free-growing dominant or codominant tree of a representative species of the forest type at age 50. The average site index in North Dakota is 53 feet. This means that on average a 50-year-old dominant or codominant tree in a stand will be 53 feet tall.

Site index varies widely by forest type. A site index that is excellent for one forest type would only be average for another type. For example, the average site index for cottonwood is 64 (fig. 9). The best oak sites in North Dakota fall into the 61-70 site index class. Therefore, in North Dakota, commercial forest land in the 61-70 site index class would be called excellent if it were supporting oak but only average if supporting cottonwood.

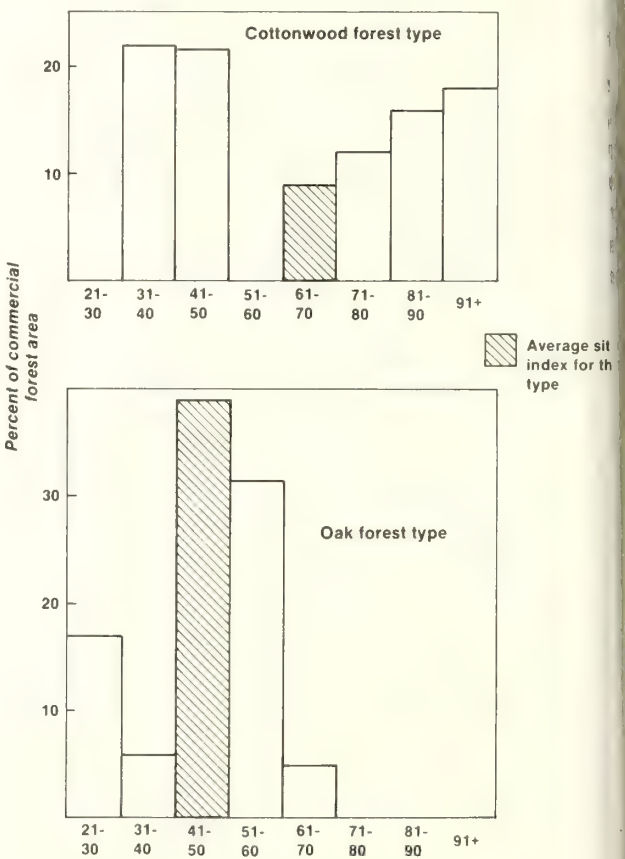


Figure 9. — *Distribution of commercial forest land by site index for cottonwood and oak forest types, North Dakota, 1980. (Although our sample did not show any cottonwood type with site index 51-60, there is probably some land in this class.)*

ads provide easy access to forests

Many forested areas in the State can be easily ached by existing roads. Data from the second rth Dakota Forest Inventory indicate that 95 per- t of the commercial forest area is within 1 mile of a intained road (fig. 10). There are 8,200 acres of oak d aspen forest types more than 10 miles from a road; e remaining 335,000 acres of commercial forest land e within 5 miles of a road.

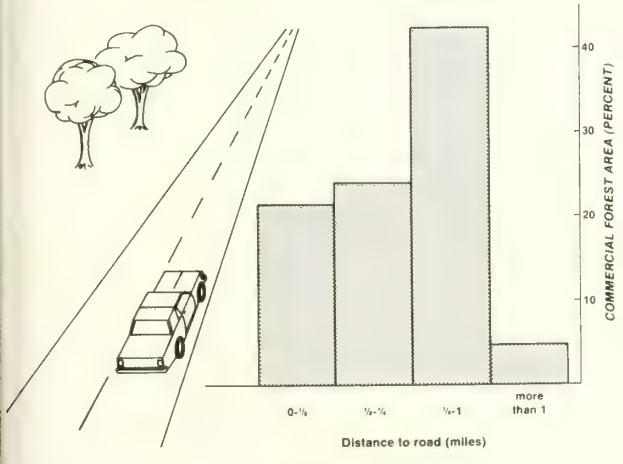
rest types vary in proximity to water

In North Dakota, vegetation is often limited by lack water. During the second Forest Inventory, photo erpreters measured the distance of forested areas m the nearest stream (at least 120 feet wide), lake, reservoir (at least 1 acre in area).

Nearly one-third of North Dakota's commercial est land is within 1/8-mile of a lake or stream — ere the relatively high water tables and spring oding provide the water necessary for trees to sur- e (fig. 11). Proximity of forests to water is also vital wildlife habitat and desirable for many recreation- activities.

erage stand area is 47 acres

Stand area, a measure of the homogeneity of North kota's commercial forest land, shows the extent of a en forest type, stand-size class, and density. It is termined during aerial photo interpretation. Nearly e-third (107,400 acres) of the State's commercial est land is in blocks of less than 4 acres; 18,600 es are in homogeneous blocks of at least 160 acres.



gure 10. — *Distribution of commercial forest land by distance to road, North Dakota, 1980.*

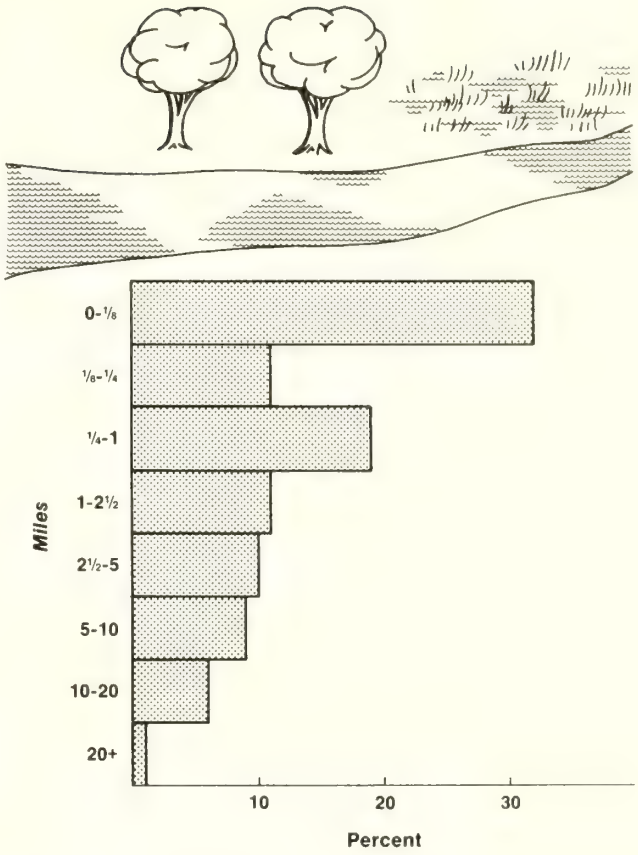


Figure 11. — *Distribution of commercial forest land by distance to water, North Dakota, 1980.*

Inventory and Number of Trees on Commercial Forest Land

Aspen is most common

More than 162.6 million live trees 1 inch in diameter and larger were found on North Dakota's 343,200 acres of commercial forest land, averaging 474 trees per acre. Aspen is the most common tree in the State, accounting for 38 percent of all live trees (fig. 12). The oak and ash species groups account for an additional 17 percent each.

When the total number of live trees in the State are plotted by diameter class, they form an inverse J-shaped curve, characteristic of a well-structured uneven-aged forest (fig. 13). It is necessary to have an abundance of young trees to ensure that enough will reach the size or quality desired by the forest owner or manager.

Of the total number of live trees, 27 percent are cull trees (rough and rotten or short log) and 73 percent are growing-stock trees. As trees grow larger (and older), they become more susceptible to rot and are

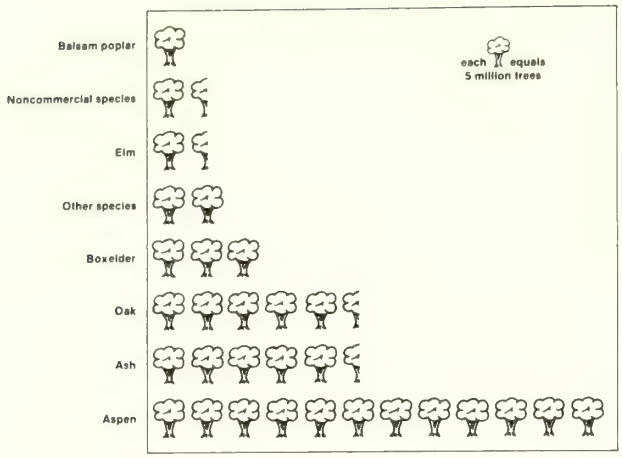


Figure 12. — *Number of all live trees 1 inch in diameter and larger by species group, North Dakota, 1980.*

more likely to be rough or have poor form, resulting in a cull classification. This is the case in North Dakota — 20 percent of the trees in the 2-inch diameter class are cull compared to 46 percent of the trees in the 12-inch class.

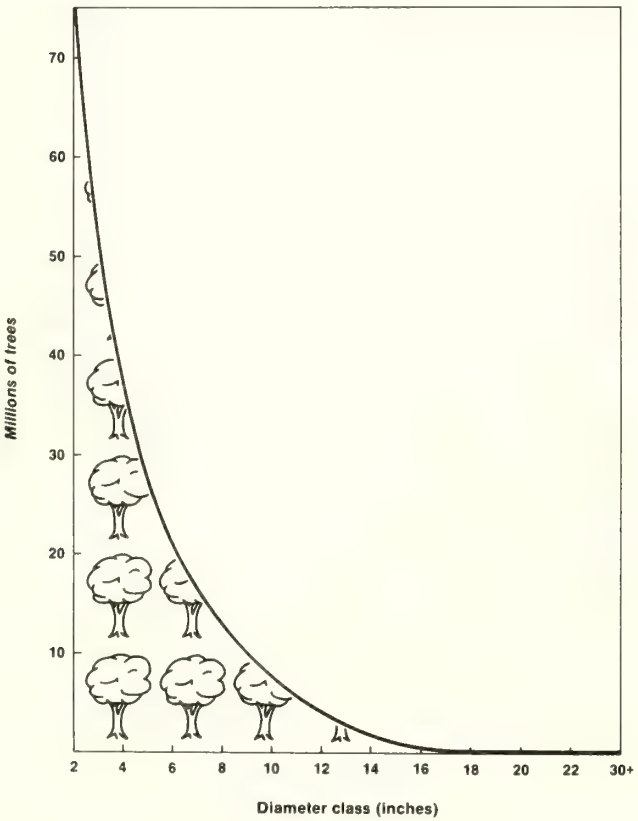


Figure 13. — *Number of all live trees 1 inch in diameter and larger by diameter class, North Dakota, 1980.*

Inventory concentrated in growing-stock trees

The cubic-foot inventory volume in all trees on commercial forest land totals 302.1 million cubic fe — 207.1 million in growing-stock trees, 89.0 milli cubic feet in cull trees, and 6.0 million cubic feet salvable dead trees (fig. 14). The proportion of tot inventory in growing-stock trees (69 percent) is fair consistent across the Plains States. The hardwo species have 68 percent of their 300.4 million cub feet of live inventory in growing-stock trees, 25 pe cent in rough and rotten cull, 5 percent in short-l

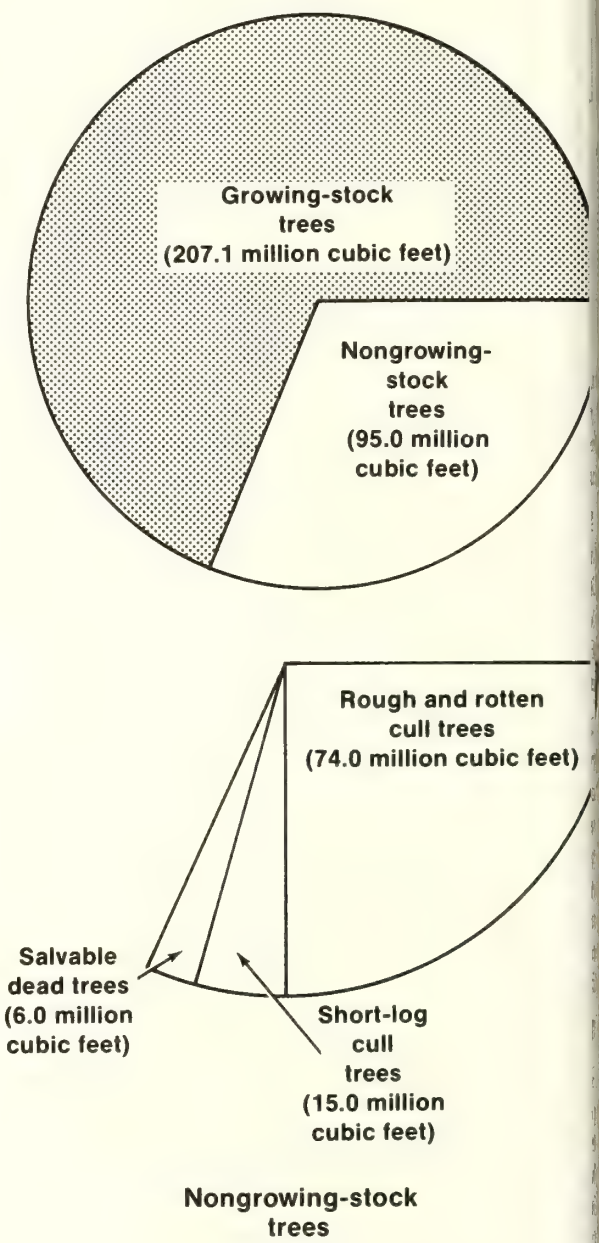


Figure 14. — *Timber volume by class of timber, Nor Dakota, 1980.*

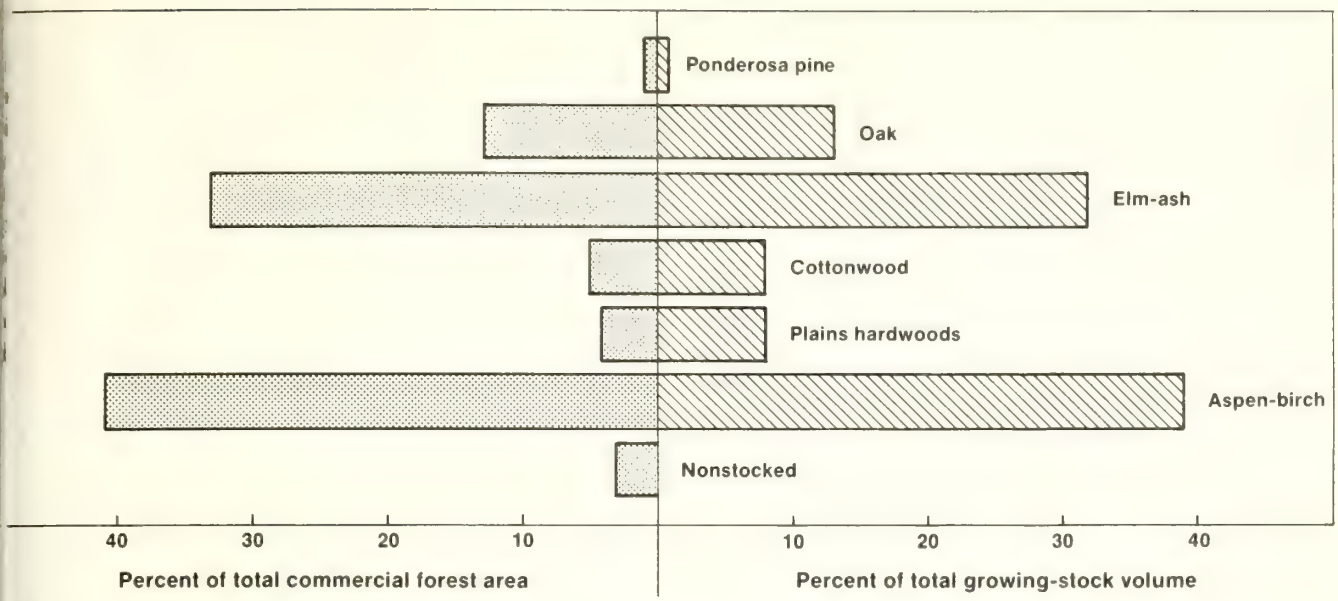


Figure 15. — *Distribution of commercial forest area and growing-stock volume by forest type, North Dakota, 1980.*

ll, and 2 percent in salvable dead trees. Most of the 3 million cubic feet of softwoods is in growing-stock ees, except for 98,100 cubic feet of rough and rotten ll.

Growing-stock inventory is composed of sawtimber d poletimber trees. Fifty-three percent of the North akota growing-stock inventory is in poletimber, 0.5 million cubic feet. Sawtimber trees account for .6 million cubic feet, equivalent to 509.9 million ard feet.[3]

Just as the aspen forest type accounts for the largest rtion of the commercial forest area, it holds the rgest portion of North Dakota's growing-stock in- ntory (fig. 15). Sawtimber inventory, however, is ncentrated in the elm-ash forest type. Fifty-five rcent of the elm-ash stands are sawtimber size, mpared to only 4 percent of the aspen stands. Aspen ands are concentrated in poletimber (63 percent) d sapling and seedling stands (33 percent).

olumes per acre consistent with other Plains States

On average, there are 603 cubic feet of growing stock r acre of commercial forest land in North Dakota. verage sawtimber volume per acre is 1,486 board et. The growing-stock inventory per acre in the ate is consistent with that reported for eastern uth Dakota and Nebraska, and slightly higher than that for Kansas. The highest growing-stock and sawtimber inventories per acre occur in the Plains hardwoods forest type:

Forest type	Growing-stock volume per acre (Cubic feet)	Sawtimber volume per acre (Board feet)
Ponderosa pine	807	1,501
Oak	597	1,060
Elm-ash	577	2,163
Cottonwood	896	3,732
Plains hardwoods	1,054	4,785
Aspen	574	492
Nonstocked	8	—
All types	603	1,486

The Plains hardwoods forest type is made up primarily of sawtimber stands at least 61 years old with high basal areas — these characteristics tend to produce high volumes per acre. The low sawtimber volumes per acre in the aspen forest type are the result of so little aspen in sawtimber-size trees.

Aspen predominates inventory

The total inventory volume in any forest type is the sum of the volumes in the various species composing the type. For example, the aspen forest type has 80.0 million cubic feet of growing-stock volume — 72 percent in aspen species. Twelve percent of the aspen

[3]*International 1/4-inch rule.*

forest type inventory is in balsam poplar; birch, oak, elm, ash, and boxelder are also found in the type.

The largest portion (29 percent) of the State's growing-stock inventory is in aspen (fig. 16). The 59.9 million cubic feet of aspen growing-stock inventory is concentrated on farmer-owned commercial forest land in trees less than 12 inches in diameter. Four other species groups — ash, elm, oak, and cottonwood — account for most of the remaining growing-stock inventory.

Hardwood growing-stock inventory occurs across a range of diameter classes, but the 10-inch diameter class holds the largest volume. Growing-stock inventory in trees more than 20 inches in diameter is generally found in the cottonwood or elm species groups. These two groups account for more than 44 percent of the sawtimber inventory (fig. 17). All softwood growing-stock inventory is in ponderosa pine less than 13 inches in diameter.

Volumes per acre vary by owner

As with commercial forest area, farmers hold most of North Dakota's growing-stock inventory (82 percent). However, the growing-stock inventory volumes per acre of commercial land vary widely by ownership class:

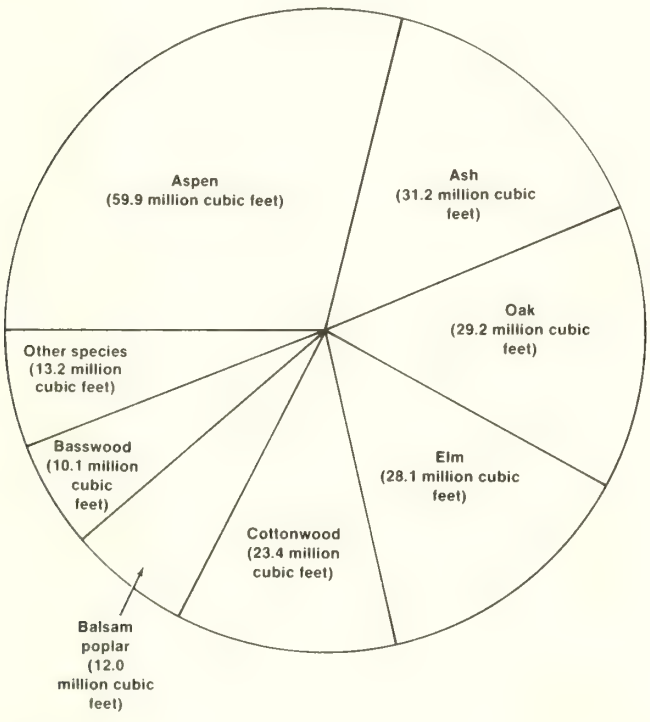


Figure 16. — *Net volume of growing stock on commercial forest land by species group, North Dakota, 1980.*

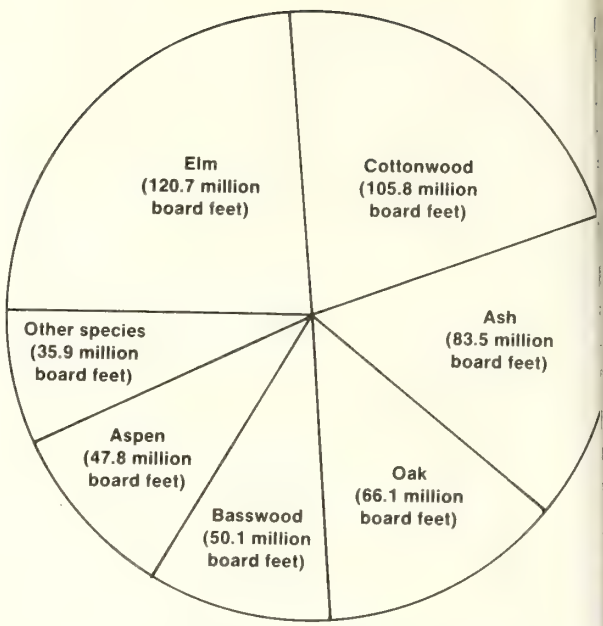


Figure 17. — *Net volume of sawtimber on commercial forest land by species group, North Dakota, 198*

Ownership class	Growing-stock volume per acre (cubic feet)
State	773
Farmer	648
County and municipal	588
Private individual	556
Miscellaneous federal	385
Indian	305
National forest	133
All owners	603

The lowest growing-stock inventory per acre, 1 cubic feet, occurs on National Forest land, because a National Forest stands are sapling and seedlin stands with very little growing-stock inventory. Th high growing-stock inventories per acre on State owned land is in the aspen forest type, a type wit very low average inventories per acre. However, th high growing-stock inventories per acre in this owne ship class can be attributed to the higher quality site on State-owned commercial forest land. For exampl the average site class rating for this land is 67 cubi feet of growth per acre per year, 40 percent highe than the average for all commercial forest land in th State. The average site index for State-owned com mercial forest land is 62, 17 percent higher than th average for all commercial forest land.

Biomass totals 16.3 million green tons

Biomass on commercial forest land in North Dakot totaled 16.0 million green tons of trees and 885,32

green tons of shrubs. Tree biomass is made up of 5 components:

1. **Growing-stock boles** — the total aboveground volume (including the bark) in growing-stock trees 5 inches in diameter and larger from a 1-foot stump to a variable 4-inch top diameter outside bark (t.d.o.b.);

2. **Growing-stock tops and limbs** — the aboveground volume (including the bark) in growing-stock trees 5 inches in diameter and larger from a 1-foot stump, excluding the growing-stock bole;

3. **Cull tree boles** — the aboveground volume (including the bark) in cull trees 5 inches in diameter and larger from a 1-foot stump to a 4-inch t.d.o.b.;

4. **Cull tree tops and limbs** — the aboveground volume (including the bark) of cull trees 5 inches in diameter and larger from a 1-foot stump, excluding the cull bole;

5. **1- to 5-inch trees** — the total aboveground volume (including the bark) of all trees 1 to 5 inches in diameter.

The largest portion of North Dakota's tree biomass is in growing-stock boles:

Component	Biomass (Million green tons)
1- to 5-inch trees	2.7
Growing-stock	
Boles	6.0
Tops and limbs	2.9
Cull	
Boles	2.8
Tops and limbs	1.6
All components	16.0

Shrub biomass is the total aboveground volume in shrubs and in trees less than 1 inch in diameter. In eastern North Dakota, shrub biomass averages 1,322 pounds per acre, concentrated in hazel. The average shrub biomass in western North Dakota is 1,134 pounds per acre, concentrated in honeysuckle (fig. 18).

Figure 18. — *The weight of the total aboveground volume in shrubs and in trees less than 1 inch in diameter averages 1,290 pounds per acre of commercial forest land.*

Net Annual Growth and Removals on Commercial Forest Land

Net annual growth averages 22 cubic feet per acre

Net annual growth of growing stock in North Dakota was 7.7 million cubic feet in 1979, or 22 cubic feet per acre. North Dakota's net annual growth per acre is

comparable to that reported in 1976 for Kansas, Nebraska, and eastern South Dakota. Growth rate is a term often used in comparing net annual growth in different States or among different species or ownership classes. Growth rate is the volume of growing-stock net annual growth divided by the volume of growing-stock inventory. Values generally run between 2 and 6 percent. The growth rate in North Dakota was 3.7 percent of inventory, again very close to the 3.3 percent average for the other three Plains States.

The majority of the net annual growth volume occurs in the aspen forest type. The 4.1 million cubic feet of aspen net annual growth averages out to 29 cubic feet per acre, or a rate of 5.1 percent. The ponderosa pine type exhibited the highest net annual growth per acre (46 cubic feet) and growth rate(5.7 percent). This high growth volume on so little commercial forest land was the result of much ingrowth, trees entering the poletimber class where they th count in determining growing-stock inventory.

Most of the growing-stock net annual growth occ s in trees less than 11 inches in diameter, where grow rates are on average much higher than in the lar diameter classes (fig. 19). In seedling and sapling poletimber stands, because small increases in cu foot volume represent large percentage increases volume, the growth rates are higher than those fou in sawtimber stands. High growth rates are comm in species groups that have most of their trees in t smaller diameter classes (e.g., ponderosa pine, bals poplar, aspen, and paper birch). A similar relati exists between stand age and the volume of net annu growth — the older the stand the lower the grow rate and the smaller the percent of the total n annual growth volume that occurs in the stan

Farmer-owned commercial forest land accounts 80 percent of the growing-stock net annual grow

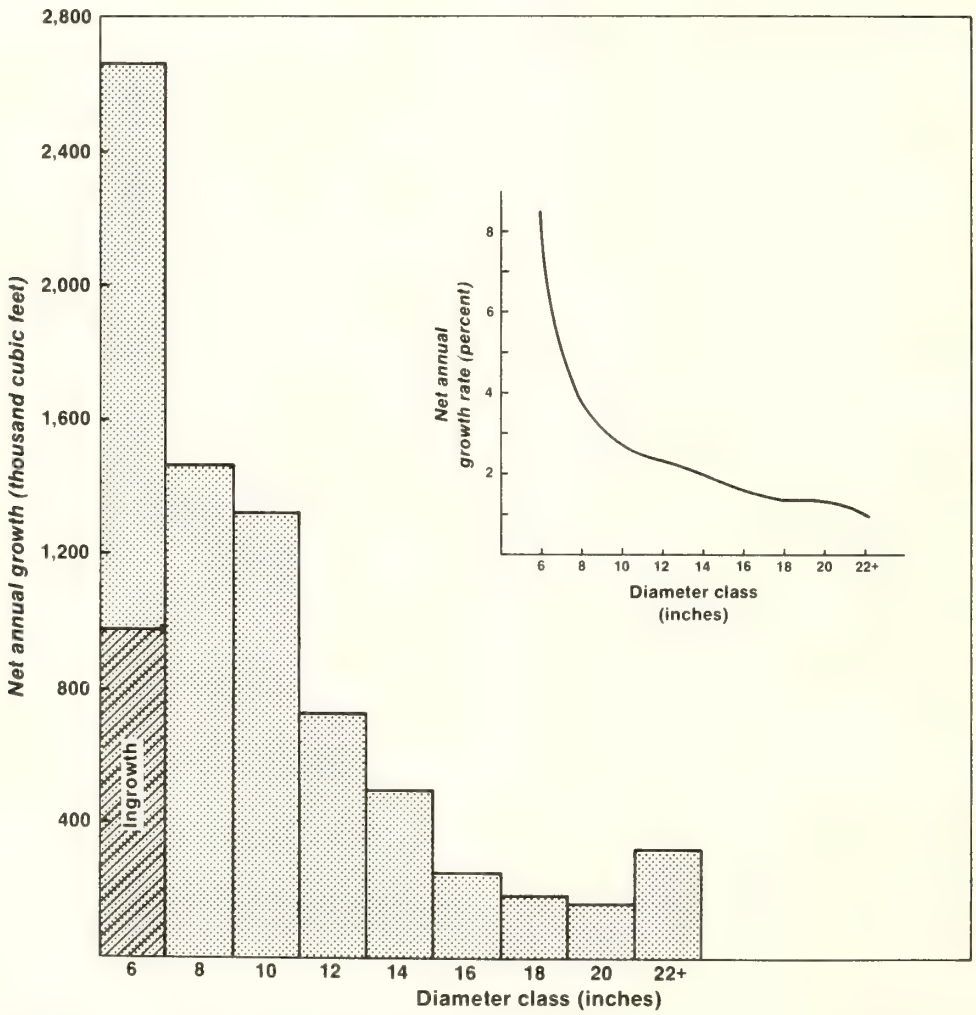


Figure 19. — *Net annual growth of growing stock and net annual growth rates on commercial forest land by 2-inch diameter class, North Dakota, 1979.*

ıt the young county- and municipal-owned forests ıd the State-owned forests have the highest volumes net annual growth per acre (31 cubic feet and 30 ıbic feet, respectively). The 6.5-percent growth rate ı National Forest land, the highest rate of any own- ship class, reflects the fact that all National Forest mmercial forest land is in seedling and sapling ands.

Sawtimber growth totaled 30.2 million board feet. lthough sawtimber volume is concentrated in the m-ash forest type (48 percent of the total), the aspen pe accounts for the largest portion of sawtimber owth. This is because aspen sawtimber stands fall to the lower end of the sawtimber diameter range ardwood sawtimber trees must be at least 11 inches diameter) where growth rates are higher.

wenty percent of total removals go to products

Average annual growing-stock removals on com- ercial forest land totaled 1.5 million cubic feet in orth Dakota in 1979. Of this total, 77 percent went to her removals, 22 percent went to roundwood prod- cts, and 1 percent went to logging residue (fig. 20).

The 1.2 million cubic feet of other removals re- esent trees that were removed from the commercial rest land base but not utilized for products. Other movals would include trees lost due to reservoir ooding, trees left standing but removed from the mmercial forest land base due to changes in land e (e.g., commercial forest land being reclassified as oductive-reserved forest land), and trees removed ring timber stand improvement work but not ilized.

Growing-stock removals for roundwood products taled 323,000 cubic feet. Fuelwood accounted for ost of the roundwood product output (61 percent), llowed by saw logs (36 percent) and posts (3 ercent).

Aspen removals totaled 567,000 cubic feet, 38 per- nt of the total; oak and cottonwood together con- ibuted another 493,000 cubic feet. Average annual movals from ponderosa pine totaled 7,000 cubic et.

Sawtimber average annual removals totaled 2.9 mil- on board feet in 1979 (fig. 21). Again, most of the movals volume was lost to other removals; only 41 ercent of total sawtimber removals went to round- ood products. Saw logs accounted for more than half the roundwood products removals. Cottonwood movals made up one-third of the total sawtimber movals; aspen and oak each made up an additional 3 percent.

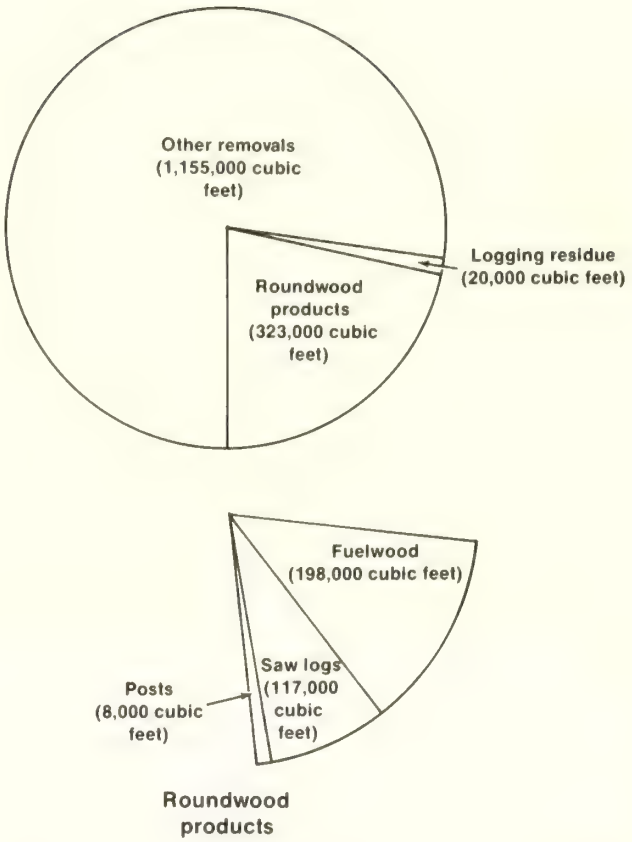

Other removals (1,155,000 cubic feet)
Logging residue (20,000 cubic feet)
Roundwood products (323,000 cubic feet)
Fuelwood (198,000 cubic feet)
Saw logs (117,000 cubic feet)
Posts (8,000 cubic feet)
Roundwood products

Figure 20. — *Average annual growing-stock removals on commercial forest land by item, North Dakota, 1979.*

Removals are 20 percent of growth

Net annual growth and average annual timber removals are often compared to determine whether a stand is being fully utilized. Although many silvicultural and economic factors influence recommended harvest levels, annual removals can generally equal the volume of net annual growth without depleting the forest resource. In North Dakota, removals were only 20 percent of growth in 1979. The oaks were the most fully utilized species group — removals were more than 44 percent of growth (fig. 22). Elm was the most underutilized species group — removals were only 7 percent of growth.

Mortality on Commercial Forest Land

In North Dakota, growing-stock mortality totaled 1.6 million cubic feet in 1979. Aspen species accounted for 59 percent of the total growing-stock mortality. Ash accounted for almost one-third of the 2.8 million board feet of sawtimber mortality.

Figure 21. — *Sawtimber average annual removals totaled 2.9 million board feet in 1979. (Photo courtesy of the North Dakota Forest Service.)*

The cause of mortality differs for growing stock and sawtimber. Disease is a primary cause in both cases, but animals play a larger role in sawtimber mortality than in growing-stock mortality. The animal damage in sawtimber is probably due to grazing.

Inventory on Nonforest Land with Trees

In contrast to most north-central States, North Dakota's growing-stock inventory on nonforest land adds significantly to the total forest resource picture. Although growing-stock inventories per acre on nonforest land with trees are less than that found on commercial forest land, the many acres in this land use category make the total inventory very high

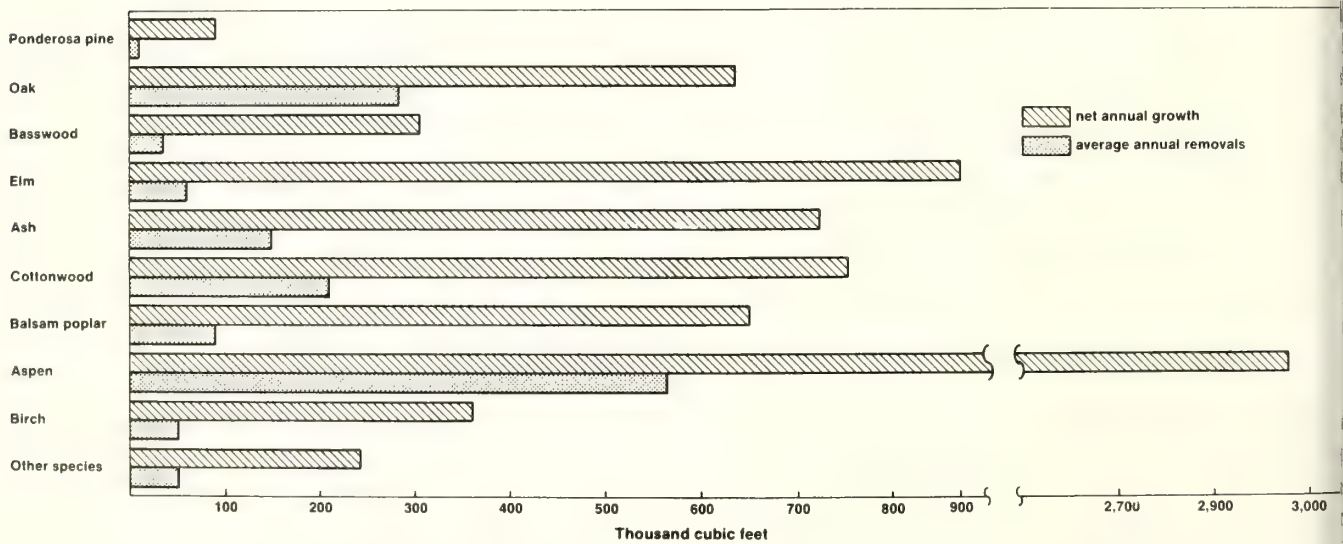


Figure 22. — *Net annual growth and average annual removals of growing stock on commercial forest land by species group, North Dakota, 1979.*

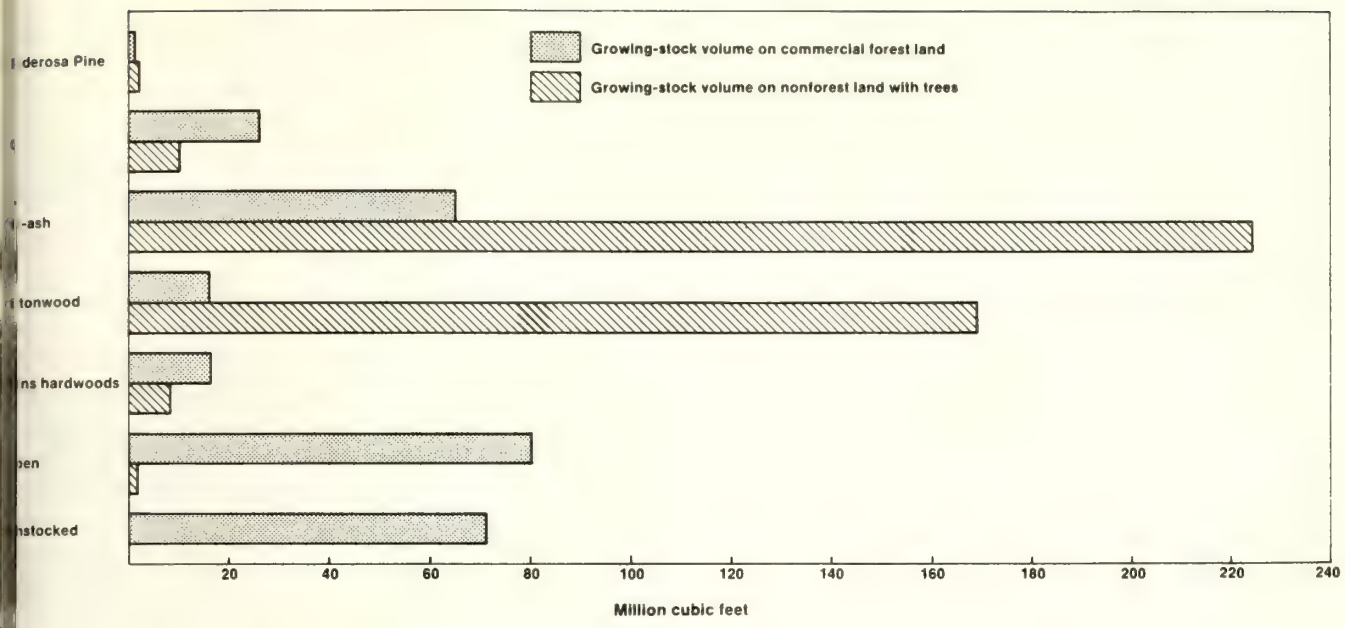


Figure 23. — *Net volume of growing stock on commercial forest land and on nonforest land with trees by forest type, North Dakota, 1980.*

rowing-stock inventory on nonforest land with trees estimated at 419.4 million cubic feet (fig. 23). When is inventory is added to that on commercial forest nd, total growing-stock inventory in the State triples 626.5 million cubic feet. The elm-ash forest type olds the largest portion of the growing-stock inventoon nonforest land with trees:

orest type	Growing-stock inventory volume (Million cubic feet)
onderosa pine	2.5
ak	10.8
m-ash	224.2
ottonwood	169.6
ains hardwoods	8.0
spen	1.5
xotic	2.6
onstocked	0.2
All types	419.4

TIMBER PRODUCTS OUTPUT

In 1977, 27 wood-using plants employing about 400 eople were in operation in North Dakota. These ants produced $18.9 million worth of products, acrding to the 1977 Census of Manufacturers.[4] Onefourth of the wood-processing facilities in the State are primary industries — industries that do not produce a finished product. The eight primary processing plants are located principally in the Turtle Mountains area and along the Missouri and Red River Valleys (fig. 24). The others, secondary industries, are involved in producing finished goods such as millwork, trusses, cabinets, furniture, pallets, prefabricated buildings, and mobile homes.[5] Much of the raw material for these secondary operations comes from outside the State.

Timber product output totaled 579,000 cubic feet in 1977. Although cutting of timber for posts, lumber, and fuelwood has declined sharply since 1954, more wood is still used for fuel (77 percent) than for any other product. The current energy situation has undoubtedly contributed to fuelwood's continued dominance as the number one timber product in North Dakota. Nearly all the output came from roundwood products; only 19,000 cubic feet came from plant byproducts. Fifty-eight percent of all plant residues were utilized, and nearly one-third of this material was used for fuel.

[4] *U.S. Department of Commerce. 1977. Census of Manufacturers, North Dakota. Geographic Series MC 77-A-35, p. 35-38.*

[5] *North Dakota Business and Industrial Development Department, North Dakota Manufacturers Directory, 1980-1981.*

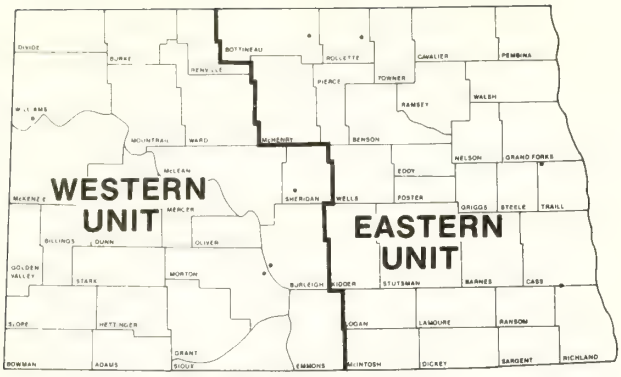


Figure 24. — *Primary wood-processing plants, North Dakota, 1980.*

THIRTY-YEAR PROJECTIONS

The U.S. Forest Service's recently completed RPA assessment of the Nation's forest and rangeland renewable resources shows that demand for most forest products will increase rapidly over the next 50 years.[6] This rising demand is in response to projected increases in population, economic activity, and income, and in response to continuing trends (1950-1976) in stumpage and timber prices. The demand for timber from the Nation's forests is expected to jump from 13.3 billion cubic feet in 1976 to 22.7 billion in 2030.

Although North Dakota's timber resources will not play a large role in meeting the Nation's future timber supply or affecting future demand, a comparison of the State's timber outlook with the Nation's is appropriate. In addition, if forest managers and planners in the State can project what is likely to happen to the State's forests under differing levels of removals, they can modify current forest practices or timber marketing strategies, if necessary.

Through computer simulation, we were able to look into North Dakota's future and project forest conditions in the year 2010 for two levels of timber removals. The stand projection technique we used requires as input (1) the number of all live trees by 2-inch diameter class, (2) radial growth by 2-inch diameter class, (3) mortality rates by 2-inch diameter class, (4) removals rates by 2-inch diameter class, (5) total removals for each year of the projection, and (6) ingrowth into the 2-inch diameter class.

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[6] *U.S. Department of Agriculture, Forest Service. 1980. An analysis of the timber situation in the United States, 1952-2030.*

Assumptions common to both projections inclu (1) radial growth will decline in response to increas in basal areas per acre, (2) forest management w continue at current levels, and (3) the volume of oth removals will drop during the period as utilizati improves, and the rate of decline in commercial fore area slow.

Low Removals Option Projectio

The low removals option assumes that product r movals will increase 4 percent between 1979 and 198 after 1980, removals for products will increase a additional 0.17 percent annually through 2010 (e.g., percent between 1979 and 1980, 4.17 percent betwe 1980 and 1981, 4.34 percent between 1981 and 198 Meanwhile, other removals will increase 3 perce between 1979 and 1980, and then the rate of increa will decline between 1980 and 2010 (fig. 24). A decli in the rate of increase in other removals reflects t belief that North Dakota's forest resources will utilized more completely during the projection peri and that the decline in commercial forest area w stabilize.

The low removals option projection shows growin stock removals increasing from 1.5 million cubic fe in 1979 to 4.4 million cubic feet in 2010 (fig. 25 Growing-stock net annual growth rises sharply duri the first 10 years of the cycle, then levels off at arou 12 million cubic feet in 1995, and remains at that leve Growing-stock inventory increases 130 percent b tween 1980 and 2010. Increased removals and a stab volume of net annual growth will eventually slow t increase in inventory, but as long as growing-stock n annual growth is higher than removals, inventory wi build.

High Removals Option Projection

The high removals option assumes that produc removals will increase 8 percent between 1979 an 1980 and then increase an additional 0.24 percen annually through 1990 (fig. 26). Beginning in 199 removals will increase 0.12 percent annually throug the projection period. Other removals will increase b 3 percent between 1979 and 1980 and then increase b progressively smaller amounts. By the last 3 years o the projection, other removals will be fairly constant

The high removals option projection shows grow ing-stock removals increasing from 1.5 million cubi feet in 1979 to 10.0 million cubic feet in 2010. Again growing-stock net annual growth rises steadily th

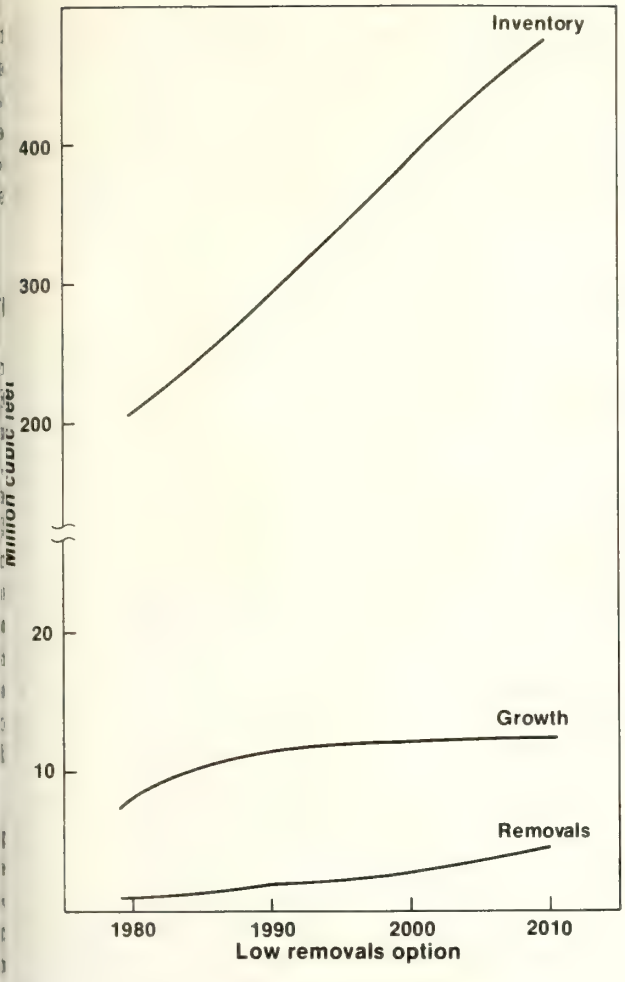

Figure 25. — *Removals, net annual growth, and inventory of growing stock on commercial forest land in North Dakota, 1980, and low removals option projections for 1981-2010.*

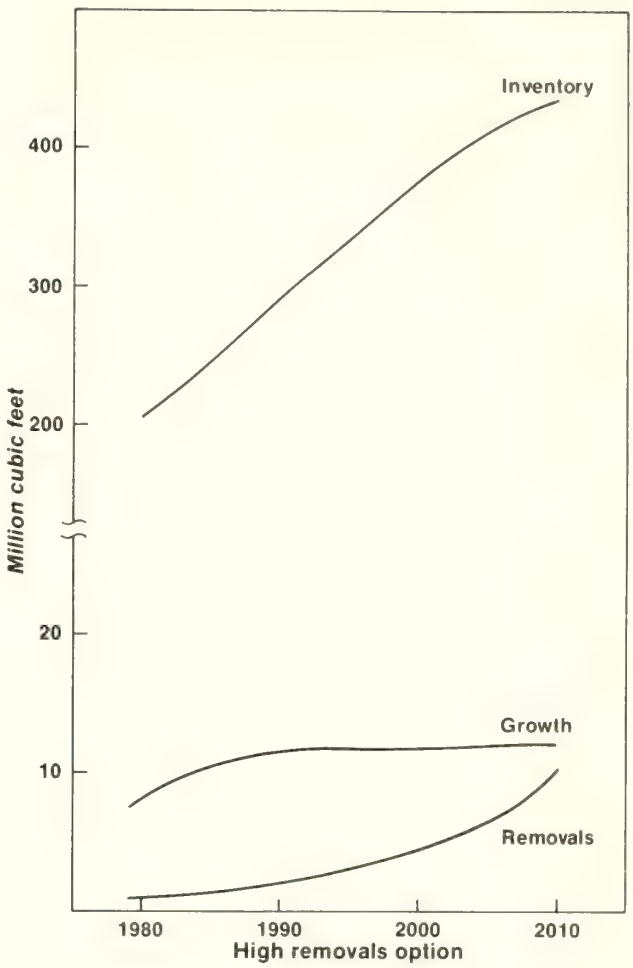

Figure 26. — *Removals, net annual growth, and inventory of growing stock on commercial forest land in North Dakota, 1980, and high removals option projections for 1981-2010.*

irst 10 years of the projection period. After 1990, net nnual growth levels off at between 11.5 and 12.0 nillion cubic feet. The interaction between net annual rowth and removals has a dampening effect on inventory. Between 1980 and 1995, growing-stock inventory ncreases fairly steadily; however, after 1995, the rate f increase in growing-stock begins to decline. If the 0-year high option projection trends in growing-tock net annual growth and removals continue beond 2010, growing-stock inventory will level off and eventually decline.

Meaning of the Projections

These 30-year projections are just two of many harvest scenarios possible for North Dakota. What ctually occurs over the next 30 years will probably fall somewhere between the two options presented here. Because of the many uncertainties affecting the projections, the data are probably most meaningful for the first decade.

The data show that North Dakota can support an increase in growing-stock removals while continuing to build growing-stock inventory. It is up to forest managers and planners in the State to decide how best to use this information to meet North Dakota's future forest resource needs.

These estimates will be conservative if management of North Dakota's forests intensifies. The projections were done for the State as a whole, but removal decisions for each timber stand must be based on the stand's physical characteristics and silvicultural needs as well as on economic criteria.

TREATMENT OPPORTUNITIES

To help evaluate renewable resource investment options, we identified treatment opportunities for projected North Dakota forest conditions in the decade 1980-1989. The treatments evaluated were: (1) harvest, (2) thinning (commercial and precommercial), and (3) stand conversion or restocking. Projected stand conditions were compared to treatment criteria and the area qualifying for each treatment during the decade was determined. Volumes in stands selected for treatment were tabulated; they represent volumes that could be removed if treatments were carried out.

Treatment criteria for North Dakota were adopted from criteria identified in other north-central States. Representatives from the North Dakota Forest Service, and the State and Private Forestry and the National Forest System branches of the USDA Forest Service adapted the criteria to the State (table 3).

Treatment opportunities vary according to the criteria specified. Our findings stem from just one of many possible sets of treatment options.

Assumptions

To conduct the analysis, three assumptions were made: (1) the area of commercial forest land will remain stable for the decade 1980-1989, (2) all commercial forest land is available for treatment, and (3) a ready market exists for all species and products. The analysis did not take into account possible economic, social, or political constraints on treatment opportunities.

Method

As mentioned earlier, three broad treatment categories were identified for North Dakota: (1) harvest, (2) thinning (commercial and precommercial), and (3) stand conversion or restocking. Harvest cuts are final cuts. Harvest acreage is not included in the stand conversion or restocking category, because it was assumed that harvest is followed by artificial or natural regeneration.

The logic used to assign treatments to each forest inventory plot is described in detail in the Appendix.

Table 3. — *Harvest and timber stand improvement criteria used in assessing treatment opportunities, North Dakota, 1980*

Forest type	Site index range	Rotation age for harvest	Thinning[1]	
			Basal area for thinning	Post thinning basal area
	Feet	*Years*	*Square Feet*	
Ponderosa pine	0-50	100	110	80
	51+	120	110	80
Oak	0-55	110	90	[2]65
	56+	80	90	[3]65
Elm-ash	All sites	80	90	70
Cottonwood	All sites	60	95	60
Plains hardwood	All sites	90	90	65
Aspen	All sites	40	—	—

[1]Stands must be more than 10 years from harvest age to be considered for thinning.

[2]Stands must be less than 41 years old to be considered for thinning.

[3]Stands must be less than 51 years old to be considered for thinning.

Harvest Treatment Opportunities

Area

According to the treatment criteria used in the analysis, 135,400 acres of commercial forest land could be harvested by 1989 (table 4). More than half of the acreage is found in the aspen forest type. Ponderosa pine is the only forest type that has no stands ready for harvest.

Table 4. — *Area of commercial forest land qualifying for treatment by forest type and treatment class, North Dakota, 1980-1989*

(In thousand acres)

Forest type	All classes	Treatment class			
		Harvest	Thinning	Stand conversion or restocking	No treatment
Ponderosa pine	2.1	—	—	—	2.1
Oak	44.2	1.7	—	—	42.5
Elm-ash[1]	122.9	49.4	9.9	17.2	46.4
Cottonwood	18.7	5.1	3.0	3.4	7.2
Plains hardwood	15.8	7.3	—	—	8.5
Aspen	139.5	71.9	—	7.1	60.5
All types	343.2	135.4	12.9	27.7	167.2

[1]Includes 9,200 acres of nonstocked commercial forest land.

Many stands in North Dakota are mature and in ed of harvest (fig. 27). More than 51 percent of the ate's total aspen acreage qualified for harvest as did percent of the Plains hardwoods acreage and 40 rcent of the elm-ash acreage. In the elm-ash forest pe many stands are overmature; 31 percent of the ea consists of stands more than 10 years past rotaon age.

Nearly one-third of the stands in the harvest catery are found on sites with site index of more than 60. ost high site harvest areas are found in the aspen rest type. The low site areas are commonly elm-ash ands. The average area of a stand selected for harst is 55 acres (table 5). More than 32 percent of the rvest area is in stands of at least 40 acres; 18 percent the area is in stands of more than 80 acres.

igure 27. — *Nearly 40 percent of North Dakota's commercial forest land is at or exceeds recommended rotation ages. (Photo courtesy of the North Dakota Forest Service.)*

Volume

Timber volume on commercial forest land selected for harvest totals 142.7 million cubic feet during the decade, 116.9 million cubic feet in growing-stock trees:

Tree class	Ten-year harvest volume (Million cubic feet)
Growing-stock	116.9
Cull	
Short-log	4.2
Rough and rotten	18.3
Salvable dead	3.3
All classes	142.7

The volume of salvable dead trees is the estimated mortality on the plots scheduled for treatment during the decade. Harvesting those trees that are projected to die during the decade will salvage 3.3 million cubic feet of timber that would have otherwise been lost.

An average of 864 cubic feet of growing stock would be removed for every acre of commercial forest land harvested. Growing-stock removals per acre are higher in the oak forest type than in any other type:

	Removals per acre (Cubic feet)
Ponderosa pine	—
Oak	1,824
Elm-ash	632
Cottonwood	804
Plains hardwoods	1,027
Aspen	987
All types	864

Table 5. — *Area of commercial forest land qualifying for treatment by stand area class and treatment class, North Dakota, 1980-1990*
(In thousand acres)

Stand Area class (acres)	All treatments	Treatments			
		Harvest	Thin	Stand conversion or restocking	No treatment
1-4	107.4	32.1	8.7	9.0	57.6
5-9	50.0	19.3	—	4.0	26.7
10-19	43.1	16.2	—	2.3	24.6
20-39	47.4	24.4	2.5	5.1	15.4
40-79	41.8	19.5	1.7	3.9	16.7
80-159	34.9	13.4	—	3.4	18.1
160-319	8.9	6.4	—	—	2.5
320-639	9.7	4.1	—	—	5.6
more than 640	—	—	—	—	—
All classes	343.2	135.4	12.9	27.7	167.2

The aspen forest type, 53 percent of the harvest area, holds 61 percent of the growing-stock harvest volume.

The majority of the growing-stock harvest volume is found in sawtimber trees. Aspen species account for nearly one-half of growing stock targeted for removal.

Thinning Treatment Opportunities

Area

Only 12,900 acres of commercial forest land qualified for thinning over the decade. The elm-ash and cottonwood forest types were the only types to have stands in need of thinning — 9,900 acres and 3,000 acres, respectively.

All thinned stands were less than 51 years old. The average site index of stands selected for thinning was 60. The 3,000 acres of cottonwood requiring thinning were all in site index class 81-90. Although most of the thinned area is in stands of less than 5 acres, 4,200 acres of elm-ash are in stands of at least 20 acres.

Volume

Volumes from thinnings total 4.1 million cubic feet for the decade, 3.0 million cubic feet in growing-stock trees. The average growing stock removed during thinnings is 231 cubic feet per acre thinned. Most (89 percent) of the thinned growing-stock volume is in poletimber trees. Cottonwood trees account for a majority of the volume.

Stand Conversion or Restocking Treatment Opportunities

Area

In North Dakota, 27,700 acres of commercial forest land is so poorly stocked that it has been targeted for stand conversion or restocking during the decade. These stands are found in the elm-ash (17,200 acres), aspen (7,100), and cottonwood (3,400) forest types.

Although stands in this treatment class are found in a range of stand-age classes, nearly half are more than 80 years old. The average site index of stands selected for stand conversion or restocking is 50; 3,400 acres of cottonwood have a site index of at least 91. The majority of the area is in stands of less than 20 acres.

Volume

By clearcutting these stands before stand conversion or restocking, 15.1 million cubic feet could be recovered during the decade — 11.9 million cubic feet in growing-stock trees. This averages to 430 cubic f of growing stock removed per acre undergoing conv sion or restocking. Most growing-stock volume moved is in sawtimber trees.

Discussion

According to the criteria used in this analys 176,000 acres of commercial forest land (51 perce could receive some treatment during the decade 198 1989. Because much of the area in any forest type found in the Turtle Mountains and Pembina Hi most treatment options are concentrated in the areas. The most common treatment is harvest, occu ring on 135,400 acres during the decade. In seve forest types, more than 40 percent of the commerc forest area is harvested — aspen (52 percent), Plai hardwoods (46 percent), and elm-ash (40 percen

Most stands more than 90 years old could be ha vested. The stands older than 90 years but not in th category were targeted for stand conversion restocking, because they are poorly stocked wi growing-stock trees.

Most areas selected for treatment are on sites with site index less than 61. If priorities were assigne treatments on high quality sites would be undertak first because these sites would be expected to return higher yield per dollar invested. The 3,400 acres cottonwood in the site index class 91 + targeted f stand conversion or restocking may be such a opportunity. This cottonwood is on a high quali but underutilized site.

Besides quality, site size also affects treatment pr orities. For very small areas, it may not be economic to transport the equipment or personnel necessary f treating them. For example, 3,000 acres of cottonwoo in site index class 81-90 qualify for thinning. It woul appear, from the standpoint of site quality, that th thinning operation would be high priority. Howeve the data show that the entire 3,000 acres are in stand of 1 to 4 acres.

The harvest opportunities identified here will n result in a sustained yield or even-flow of timb volume from North Dakota's forest land. The annu harvest area and volume under even-flow manag ment would be less than that shown here. The are that could be harvested annually under an even-flo concept can be estimated by taking the total numb of acres in a forest type and dividing it by the rotatio age. For example, with the aspen forest type, th annual harvest area for even-flow management woul be about 3,400 acres per year, as opposed to the 7,20 acres per year shown here for the decade.

The treatment opportunities described here are for the entire State. For land owners who would like to estimate the volume of timber on their land to help them make management decisions, an empirical yield table has been included in the Appendix. The table shows average growing-stock volumes per acre by stand-age class for average sites of each forest type. Owners can adjust these yields to reflect their estimate of the forest site quality of their land.

For many reasons, the treatments identified here may not be carried out. Wood production may not be a priority for some land owners. Social or political considerations may limit timber management. Traditional markets may not exist for some products removed during treatment. Physical features (i.e., physiographic class, slope, distance to transportation systems) may make some sites inoperable or uneconomical. Administrative regulations may limit treatment options in other areas.

For these reasons, the acreage targeted for treatment in this report is the biological maximum available given the treatment criteria and current North Dakota forest conditions. Forest managers and planners can temper the findings to fit resource conditions in their areas.

NONTIMBER FOREST RESOURCES

RPA mandates that forest inventories assess all renewable resource outputs from forest land. Timber is a relatively easy resource to assess, and most people agree on what timber data should be collected and presented. But agreement is not universal with other forest resources. Future forest inventories will need to address the problems of assessing nontimber forest resources. For the second North Dakota Forest Inventory, a general discussion of three nontimber forest resources (recreation, water, and wildlife) is presented here.

Outdoor Recreation[7]

North Dakota citizens enjoy a variety of recreational activities in which forests play a role. Forests may make recreational activities more enjoyable by influencing water quality, providing wildlife habitat, or enhancing the aesthetic value of an area (fig. 28).

Most of North Dakota's recreational facilities are owned and managed by the State. The North Dakota Forest Service manages five State Forests comprising over 12,900 acres. The State Forests are managed on a multiple-use basis to provide a continuous supply of forest products, wildlife habitat, forage, and recreational opportunities. In north-central North Dakota seven State Forest Recreation Areas provide facilities for camping, swimming, hiking, hunting, fishing, cross-country skiing, snowshoeing, and snowmobiling.

In 1965, the State legislature created the North Dakota State Outdoor Recreation Agency to plan and coordinate a State outdoor recreation plan. In the same year, the North Dakota Park Service was formed and charged with acquiring, preserving, and developing a system of parks in areas of scenic, historical, or recreational importance.

Currently, the North Dakota Park Service administers 14 park facilities (fig. 29). In 1980, nearly 1 million people visited North Dakota's State parks, an increase of 6 percent over that reported in 1979. The popularity of these facilities can be at least partially attributed to the forests on or near them. For example, the State's most popular park, Lake Metigoshe, is situated within the aspen forests of the Turtle Mountains. The area attracts visitors year around as it offers facilities for camping, swimming, fishing, hiking, cross-country skiing, snowshoeing, and snowmobiling. The park's Old Oak Trail was designated as the first National Recreation Trail in North Dakota.

In 1980 Fort Lincoln State Park was the second most popular park. Its modern campground and picnic area are located in a scenic forested area adjacent to the Heart and Missouri Rivers.

Several federal agencies manage areas for many recreational activities. The USDA Forest Service administers 1.1 million acres of national grasslands. These areas offer opportunities for dispersed recreation, especially hunting.

The National Park Service administers the Theodore Roosevelt National Park in western North Dakota. This park is known for its natural prairie, grasslands, and wildlife. Buffalo, deer, fox, and coyotes can often be seen from park roads around daybreak; journeys into the interior can give the visitor a chance to view wild horses and bighorn sheep. Although trees are scarce in the Great Plains, Rocky Mountain juniper in coulees and draws and hardwood stands along streambanks provide wildlife habitat and refreshing shade.

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[7] *Background information and statistics supplied by John Van Ells, North Dakota Forest Service; Glenn Roloff, USDA Forest Service; and news releases and pamphlets from the North Dakota Park Service.*

Figure 28. — *The forests of North Dakota offer opportunities for a wide range of recreational activities.*

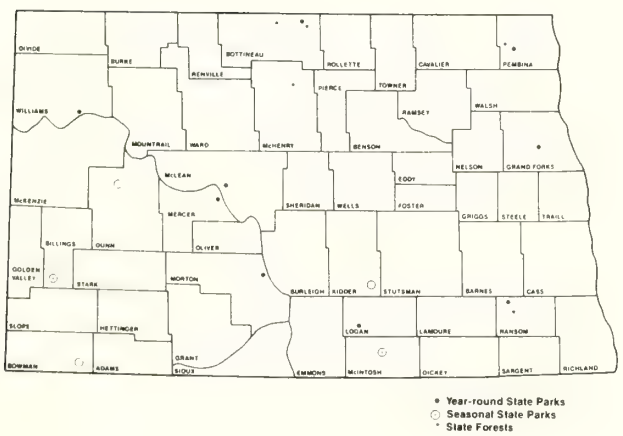

Figure 29. — *North Dakota's State Parks and State Forests.*

The U.S. Army Corps of Engineers administe many of North Dakota's reservoirs including Garr son, Homme, and Oahe Reservoirs, and Lake Asht bula. These lakes and reservoirs provide many publ recreational areas, some of which are managed by th Corps; others are leased to State, county, and loc agencies. Lake Sakakawea State Park on the sout shore of Lake Sakakawea (the lake formed by Garr son Dam) is the most popular State park for wate related recreation.

Water Resources[8]

In North Dakota, water resource problems an management opportunities center around water qua ity and the timing and distribution of precipitatio Forests can have an impact on these characteristic

[8]*Information for this section came primarily fro Mineral and Water Resources of North Dakot North Dakota Geological Survey, Bulletin 63.*

The climate of North Dakota ranges from semiarid in the west to subhumid in the east. Rainfall is erratic. Occurring mostly between April and July, precipitation averages 13 inches in the western counties and 20 inches along the eastern border each year. An estimated three-fourths of North Dakota's precipitation reaches streams, but runoff is variable. Approximately 60 percent of North Dakota's land area drains into the Missouri River and its tributaries; the rest of the State drains into Hudson Bay through the Red and Souris Rivers. Runoff averages 2.5 billion gallons of water per day. There are also large ground water reserves in the State, but poor water quality and the high retrieval costs limit their use. Many of these reserves are overlain with fairly impermeable rock, limiting recharge.

Nearly one-third of North Dakota's commercial forest land is within 660 feet of water — a river, lake, or reservoir. In addition, most of the State's 167,000 acres of wooded strips occur along rivers and streams. The high infiltration capacity of these forested soils helps moderate runoff entering surface waters. Precipitation filtered through forest soils is relatively free of sediment, thereby improving or maintaining water quality. By shading streams, forests help lower water temperatures, which is important for the survival of many fish species, such as walleye. Finally, the thousands of miles of windbreaks and shelterbelts across North Dakota help distribute snow over areas where water from the spring melt can be most useful.

Wildlife Resources[9]

North Dakota's forests provide critical habitat for many popular wildlife species including the bald eagle, wild turkey, white-tailed deer, and ruffed grouse. A look at one wildlife game species, ruffed grouse, will demonstrate the importance of maintaining and managing the timber resource to provide wildlife habitat.

The success of a ruffed grouse population is closely related to the condition of aspen forests. To flourish, ruffed grouse populations require three age classes of aspen. Broods of ruffed grouse do best in aspen stands less than 10 years old. Young aspen trees less than 4 inches in diameter provide maximum protection from raptors, the primary predator of ruffed grouse. Stands of aspen between 10 and 20 years old are preferred cover for adult birds. The male flowers of aspen between 20 and 30 years old are a primary food source for these upland game birds.

In North Dakota, ruffed grouse populations have been flourishing in the Turtle Mountains and Pembina Hills, although preliminary surveys show they may be declining in 1981. The North Dakota Game and Fish Department is managing aspen stands in the Wakopa Wildlife Management Area (in Rollette County) to improve ruffed grouse habitat. The Department cleared 20 acres of aspen in 1980 in eight 2.5-acre plots. Winter clearcuts were used to increase aspen reproduction density and improve habitat for ruffed grouse broods. The clearing operations also provided additional browse for white-tailed deer (fig. 30). Ruffed grouse populations are also being monitored in the Killdeer Mountains, where birds were introduced between 1977 and 1979. The North Dakota Forest Service performs wildlife habitat improvement work on approximately 30 acres annually in the Turtle Mountains. Five- to 10-acre clearings are made to improve habitat primarily for ruffed grouse and white-tailed deer. Both the State Forest Service and the Game Department plan to continue managing aspen stands to maintain and improve critical habitat.

The North Dakota State Game and Fish Department manages 148 wildlife management areas in 47 of the State's 53 Counties. The areas total nearly 146,500 acres, 25,400 of which are woodland. The Department participates in two major programs to help maintain wildlife habitat in the State. The Water Bank Program, administered with the help of the U.S. Department of Agriculture, pays farmers to retire their wetlands and adjacent uplands from farming. In 1980 there were 244,260 acres of land in the Water Bank Program. The Interest Money Program maintains funds for developing fish and wildlife habitat on private lands.

The sales of hunting and fishing licenses in the State show that North Dakotans value their fish and wildlife resources and the activities of the Game and Fish Department. In 1979 more than 90,000 citizens spent nearly $1 million on hunting licenses. An additional 9,800 nonresidents enjoyed hunting in North Dakota. The State sold approximately 78,250 small game licenses, 37,900 deer gun licenses, and 8,100 deer bow licenses.

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[9]*Information for this section came primarily from the 1980 Annual Report, State Game and Fish Department. North Dakota Outdoors 43(7). January, 1981.*

Figure 30. — *Management of the State's forest land can improve habitat for many popular wildlife species. (Photo courtesy of the North Dakota Forest Service.)*

APPENDIX

Accuracy of Survey

Resources Evaluation information is based on a sampling procedure designed to provide reliable statistics at the State and Survey Unit levels. Consequently, the reported figures are estimates only. Sampling errors give a measure of reliability of these figures. These sampling errors mean that the chances are two out of three that if a 100-percent inventory had been taken using the same methods, the results would have been within the limits indicated.

For example, the estimated area of commercial forest land in North Dakota in 1980 (343,200 acres) has a sampling error of ± 6.42 percent (± 22,033 acres). The commercial forest area from a 100-percent inventory, then, would be expected to fall between 321,167 and 365,233 acres (343,200 ± 22,033), there being a one in three chance that this is not the case.

The following tabulation shows the sampling errors for the 1980 North Dakota Forest Inventory:

Item	North Dakota totals	Sampling error (Percent)
Growing stock	(Million cubic feet)	
Volume	207.1	7.96
Growth	7.7	8.65
Removals	1.5	27.23
Sawtimber	(Million board feet)[10]	
Volume	509.9	11.58
Growth	30.2	14.60
Removals	2.9	25.40
Commercial forest land	(Acres)	
	343,200	6.42

As survey data are broken down into sections sma er than State or Survey Unit totals, the sampling err increases. The smaller the breakdown, the larger tl sampling error. For example, the sampling error f area of commercial forest land in a particular county higher than that for total commercial forest area the Survey Unit (table 65 shows the sampling erro for estimates smaller than State totals).

Survey Procedure

The major steps in determining the areas by lar class and forest type were as follows:

1. A total of 226,893 1-acre points were distribute systematically across aerial photos of the entire Stat These points were classified as either forest lar (2,848), unproductive forest land (401), nonforest lar (223,397), or questionable (247) to make a prelimina estimate of forest area. Next, all forest points and out of 13 of the points on unproductive forest lan nonforest land with trees, and questionable land we stereoclassified as to forest type, stand-size class, an density. Then 219 points classed as forest, 31 poin classed as unproductive, 19 points classed as questio able, and 17,183 points classified as nonforest we examined on the ground to correct the preliminar area estimate for errors in classification and for actu changes in land use since the photos were take

2. Data were compiled at the St. Paul office.

Method for Evaluating Treatment Opportunities

Treatment opportunities are projected for a decad because 10 years is viewed as a reasonable plannin period, and because ideally, forest inventories ar conducted on a 10-year basis. In practice, treatment would occur throughout the decade. An estimate o the average annual volumes removed during the treat ment must reflect the growth that would occur o

[10] *International 1/4-inch log rule.*

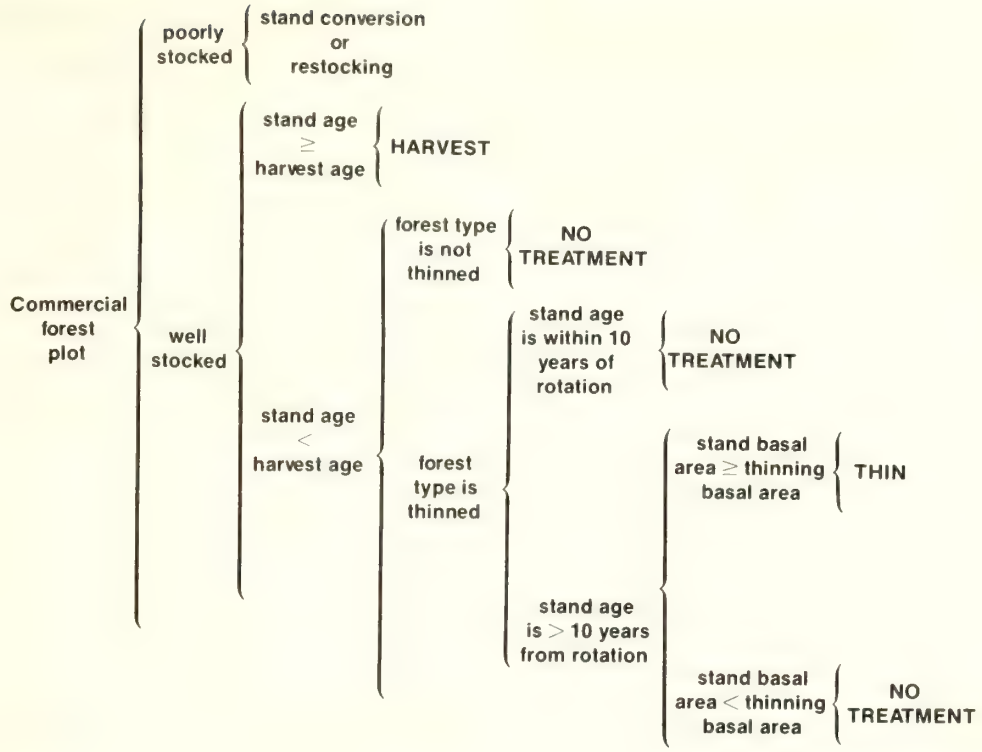

Figure 31. — *Logic used to assign treatments to commercial forest plots.*

plots between 1980 (when the data were collected) and the time of treatment. For this reason it was necessary to project each treated plot 5 years as an estimate of average growth for the decade before treatments were evaluated. To accomplish this, plot data from the 1980 North Dakota Forest Inventory were used as input to the Stand and Tree Evaluation and Modeling System (STEMS).[11] The System "grew" each plot for 5 years, calculating areas and volumes represented by the plots. After the projection, the following process was used to identify treatment opportunities (fig. 31).

(1) **Identify areas for stand conversion or restocking.** — The basal area for each plot was compared to the stand age to see if the plot would achieve full stocking. A plot was selected for stand conversion or restocking if plot basal area was $\leq 19 +$ (0.38 x stand age). Some plots at or past rotation age fell into this category. These plots were placed under the stand conversion or restocking treatment category rather than the harvest category because low stocking will probably necessitate extra regeneration efforts.

(2) **Identify areas for harvest.** — Criteria outlined in table 3 were used to calculate harvest acreage for each forest type for the decade 1980-1989. All plots at rotation age or above were selected for harvest. Harvest volume is the projected volume found on harvest plots.

(3) **Identify areas for thinning.** — Criteria outlined in table 3 were used to calculate thinning acreage for each forest type for the decade 1980-1989. Thinning was prescribed for all forest types except aspen. Stands selected for thinning must be at least 10 years from rotation age. In the oak forest type, thinning on high sites occurred only in stands less than 51 years old; thinning on low sites occurred only in stands less than 41 years old.

On plots selected for thinning, STEMS assigned the highest thinning priority to cull trees, then to growing-stock trees of undesirable species (elm, boxelder, and noncommercial species), and finally to growing-stock crop trees. Large diameter growing-stock crop trees were favored for retention during thinning oper-

[11] *U.S. Department of Agriculture, Forest Service. 1979. A generalized forest growth projection system applied to the Lake States region. U.S. Department of Agriculture Forest Service, General Technical Report NC-49, 96 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.*

ations. Trees were "thinned" from the plot until the recommended post-thinning basal area was reached. Thinning volume is the projected volume of trees removed during thinning.

Comparing North Dakota Second Survey with the First Survey

Data from new forest surveys are often compare with data from earlier forest surveys to determin trends in forest areas and volumes. Changes in proce dures and definitions between surveys make it neces sary to adjust earlier data to make them comparable In North Dakota, published 1954 commercial fores area was adjusted to take into account changes i survey procedures and definitions between surveys

Forest Service standard grades for hardwood factory saw logs

Grading factors		Specifications							
		Log grade 1			Log grade 2				Log grade 3
Position in tree		Butts only	Butts and uppers		Butts and uppers				Butts and uppers
Scaling diameter, inches		13-15[1]	16-19	20+	11+[2]		12+	8+	
Length without trim, feet			10+		10+	8-9	10-11	12+	8+
Required	Min. length, feet	7	5	3	3	3	3	3	2
clear cuttings[3]									No
of each of three	Max. number	2	2	2	2	2	2	3	limit
best faces[4]	Min. proportion of log length required in clear cutting	5/6	5/6	5/6	2/3	3/4	2/3	2/3	1/2
Maximum sweep & crook allowance	For logs with less than one-fourth of end in sound defects		15 percent				30 percent		50 percent
	For logs with more than one-fourth of end in sound defects		10 percent				20 percent		35 percent
Maximum scaling deduction			40 percent[5]				50 percent[6]		50 percent

[1]Ash and basswood butts can be 12 inches if they otherwise meet requirements for small #1's.
[2]Ten-inch logs of all species can be #2's if they otherwise meet requirements for small #1's.
[3]A clear cutting is a portion of a face, extending the width of the face, that is free of defects.
[4]A face is one-fourth of the surface of the log as divided lengthwise.
[5]Otherwise #1 logs with 41-60 percent deductions can be #2.
[6]Otherwise #2 logs with 51-60 percent deductions can be #3.

Forest Service standard specifications for hardwood construction logs (tie and timber logs)[1]

Position in tree		Butt and upper
Min. diameter, small end		8 inches+
Min. length, without trim		8 feet
Clear cuttings		No requirements.
Sweep allowance, absolute		One-fourth of the diameter of the small end for each 8 feet of length.
Sound surface defects	Single knots	Any number,if no one knot has an average diameter above the callus in excess of one-third of log diameter at point of occurrence.
	Whorled knots	Any number if sum of knot diameters above the callus does not exceed one-third of log diameter at point of occurrence.
	Holes	Any number, provided none has a diameter over one-third of log diameter at point of occurrence, and none extends over 3 inches into included timber.[2]
Unsound surface defects		Same requirements as for sound defects if they extend into included timber.[2] No limit if they do not.
End defects	Sound	No requirements.
	Unsound	None allowed; log must be sound internally, but will admit one shake not to exceed one-fourth of the scaling diameter and will admit a longitudinal split not extending more than 5 inches into the contained timber.

[1]These specifications are minimum for the class. If, from a group of logs, factory logs are selected first, thus leaving only nonfactory logs from which to select construction logs, then the quality range of the construction logs selected is limited, and the class may be considered a grade. If selection for construction logs is given first priority, then it may be necessary to subdivide the class into grades.

[2]Included timber is always square, and dimension is judged from small end.

Log Grades for Ponderosa Pine

Grade 1 — logs with three or four clear faces.[12]

Grade 2 — logs with one or two clear faces.

Grade 3 — logs with no clear faces.

After the tentative log grade is established, the log will be degraded one grade for sweep or heart rot. No log can be degraded below grade 3. Net scale after deduction for defect must be at least 50 percent of the gross contents of the log.

[12]*A face is one-fourth of the circumference in width extending full length of the log. Clear faces are those free of knots measuring more than 1/2 inch in diameter, overgrown knots of any size, or holes more than 1/4 inch in diameter. Faces may be rotated to obtain the maximum number of clear ones.*

1. **Sweep.** — Degrade any tentative 1 or 2 log one grade if sweep amounts to 3 or more inches and equals or exceeds one-third the diameter inside bark at small end.

2. **Heart rot.** — Degrade any tentative 1 or 2 log grade if conk, massed hyphae, or other evidence of advance heart rot is found.

Metric Equivalents of Units Used in this Report

1 acre = 4,046.86 square meters or 0.405 hectare.
1,000 acres = 405 hectares.
1,000 board feet (International 1/4-inch log rule) = 3.48 cubic meters.
Breast height = 1.4 meters above the ground.
1 cubic foot = 0.0283 cubic meter.
1 foot = 30.48 centimeters or 0.3048 meter.
1 inch = 25.4 millimeters, 2.54 centimeters, or 0.0254 meter.

Definition of Terms

Acceptable trees. — Growing-stock trees of commercial species that meet specified standards of size and quality but do not qualify as desirable trees.

Area-Condition Classes. — Class 10. — Areas fully stocked with desirable trees but not overstocked.

Class 20. — Areas fully stocked with desirable trees but overstocked with all live trees.

Class 30. — Areas medium to fully stocked with desirable trees and with less than 30 percent of the area controlled by other trees and/or inhibiting vegetation or surface conditions that will prevent occupancy by desirable trees.

Class 40. — Areas medium to fully stocked with desirable trees and with 30 percent or more of the area controlled by other trees and/or conditions that ordinarily prevent occupancy by desirable trees.

Class 50. — Areas poorly stocked with desirable trees but fully stocked with growing-stock trees.

Class 60. — Areas poorly stocked with desirable trees but with medium to full stocking of growing-stock trees.

Class 70. — Areas poorly stocked with desirable trees and poorly stocked with growing-stock trees.

Basal area. — The area in square feet of the cross section at breast height of a single tree. When the basal area of all trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Commercial forest land. — Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization. (Note: Areas qualifying as commercial forest land have the capability of producing in excess of 20 cubic feet per acre per year of industrial wood under management. Currently inaccessible and inoperable areas are included, except when the areas involved are small and unlikely to become suitable for production of industrial wood in the foreseeable future.)

Commercial species. — Tree species presently or prospectively suitable for industrial wood products. (Note: Excludes species of typically small size, poor form, or inferior quality such as hawthorn and sumac).

County and municipal land. — Land owned by counties and local public agencies or municipalities, or land leased to these governmental units for 50 years or more.

Cull. — Portions of a tree that are unusable for industrial wood products because of rot, form, or other defect.

Desirable trees. — Growing-stock trees of relatively high vigor having no serious defects limiting present or prospective use, and containing no pathogens that may result in death or serious deterioration before rotation age. These are trees that would be favored by forest managers in silvicultural operations.

Diameter class. — A classification of trees based on diameter outside bark, measured at breast height (4-1/2 feet above the ground). (Note: D.b.h. is the common abbreviation for diameter at breast height. Two-inch diameter classes are commonly used in Forest Survey, with the even inch the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h. inclusive.)

Farm. — Either a place operated as a unit of 10 or more acres from which the sale of agricultural products totals $50 or more annually, or a place operated as a unit of less than 10 acres from which the sale of agricultural products for a year amounts to at least $250. Places having less than the $50 or $250 minimum estimated sales in a given year are also counted as farms if they can normally be expected to produce goods in sufficient quantity to meet the requirements of the definition.

Farmer-owned land. — Land owned by farm operators. (Note: Excludes land leased by farm operators from nonfarm owners, such as railroad companies and States.)

Forest land. — Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use. (Note: Stocking is measured by comparison of basal area and/or number of trees, by age or size and spacing with specified standards. The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, or other bodies of water or clearings in forest areas shall be classed as forest if less than 120 feet wide.) Also see definitions for land area, commercial forest land, noncommercial forest land, productive-reserved forest land, stocking, unproductive forest land, and water.

orest trees. — Woody plants having a well-developed stem and usually more than 12 feet in height at maturity.

orest type. — A classification of forest land based upon the species forming a plurality of live tree stocking.

Ponderosa pine. — Forests in which ponderosa pine comprises a plurality of the stocking. In North Dakota ponderosa pine occurs in pure stands.

Oak. — Forests in which bur oak comprises a plurality of the stocking. (Common associates include ash, basswood, and elm.)

Elm-ash. — Forests in which lowland elm and ash, singly or in combination, comprise a plurality of the stocking. (Common associates include cottonwood and bur oak.)

Cottonwood. — Forests in which cottonwood comprises a plurality of the stocking. (Common associates include boxelder and elm.)

Plains hardwood. — Forests in which basswood comprises a plurality of the stocking. (Common associates include elm and oak.)

Aspen-birch. — Forests in which quaking aspen, paper birch, and river birch, singly or in combination, comprise a plurality of the stocking. (Common associates include balsam poplar, ash, and oak.)

rowing-stock trees. — Live trees of commercial species qualifying as acceptable trees. (Note: Excludes rough, rotten, and dead trees.)

rowing-stock volume. — Net volume in cubic feet of growing-stock trees 5.0 inches d.b.h. and over from a 1-foot stump to a minimum 4.0-inch top diameter outside bark (t.d.o.b.) of the central stem or to the point where the central stem no longer meets pulpwood specifications.

lardwoods. — Dicotyledonous trees, usually broad-leaved and deciduous.

dle farmland. — Includes former croplands, orchards, improved pastures, and farm sites not tended within the past 2 years and presently less than 16.7 percent stocked with trees.

mproved pasture. — Land currently improved for grazing by cultivation, seeding, irrigation, or clearing of trees or brush and less than 16.7 percent stocked with live trees.

ndian land. — Tribal land held in fee but administered by the Federal Government.

Land area. — A. Bureau of the Census. The area of dry land and land temporarily or partly covered by water, such as marshes, swamps, and river flood plains (omitting tidal flats below mean high tide); streams, sloughs, estuaries, and canals less than one-eighth of a statute mile wide; and lakes, reservoirs, and ponds less than 40 acres in area.

B. Forest Survey. The same as the Bureau of Census, except minimum width of streams, etc. is 120 feet and minimum size of lakes, etc., is 1 acre.

Live trees. — Growing-stock, rough and rotten trees 1 inch d.b.h. and larger.

Log grade. — A classification of logs based on external characteristics as indicators of quality or value.

Logging residues. — The unused growing-stock portions of trees cut or killed by logging.

Maintained road. — Any road, hard topped or other surfaces, that is plowed or graded at least once a year. Includes rights-of-way that are cut or treated to limit herbaceous growth.

Marsh. — Nonforest land that characteristically supports low, generally herbaceous or shrubby vegetation and that is intermittently covered with water.

Merchantable. — Refers to a pulpwood or saw log section that meets pulpwood or saw log specifications, respectively.

Miscellaneous Federal land. — Federal land other than National Forest, land administered by the Bureau of Land Management, and Indian land.

Miscellaneous private land. — Privately owned land other than forest-industry and farmer-owned land.

Mortality. — Standing or down dead trees that have died within the last 3 years.

National Forest land. — Federal land that has been legally designated as National Forest or purchase units, and other land under the administration of the Forest Service.

Net annual growth of growing stock. — The annual change in volume of sound wood in live sawtimber and poletimber trees and the total volume of trees entering these classes through ingrowth, less volume losses resulting from natural causes.

Net annual growth of sawtimber. — The annual change in the volume of live sawtimber trees and the total volume of trees reaching sawtimber size, less volume losses resulting from natural causes.

Net volume. — Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.

Noncommercial forest land. — (a) Unproductive forest land and (b) productive-reserved forest land.

Noncommercial species. — Tree species of typically small size, poor form,or inferior quality which normally do not develop into trees suitable for industrial wood products.

Nonforest land. — Land that has never supported forests and land formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide and more than 1 acre in area, to qualify as nonforest land.)

a. *Nonforest land with trees.* — Nonforest land with no live trees present.

b. *Nonforest land without trees.* — Nonforest land with one or more trees at least 5 inches in d.b.h. per acre.

Nonstocked land. — Commercial forest land less than 16.7 percent stocked with growing-stock trees.

Ownership. — Property owned by one owner, regardless of the number of parcels in a specified area.

Ownership size class. — The amount of commercial forest land owned by one owner, regardless of the number of parcels.

Poletimber stands. — (See stand-size class.)

Poletimber trees. — Growing-stock trees of commercial species at least 5.0 inches d.b.h. but smaller than sawtimber size.

Productive-reserved forest land. — Forest land sufficiently productive to qualify as commercial forest land but withdrawn from timber utilization through statute, administration, designation, or exclusive use for Christmas tree production as indicated by annual shearing.

Prospectively. — As used in this manual it refers to the moment a tree will reach sawtimber size at d.b.h.

Rangeland. — Land on which the natural plant cover is composed principally of native grasses, forbs, or shrubs valuable for forage.

Reserved areas. — Nonforest land with trees administered as State Parks, National Parks, or National Grasslands.

Rotten trees. — Live trees of commercial species that do not contain at least one 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough trees. — (a) Live trees of commercial species that do not contain at least one 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees of noncommercial species.

Roundwood products. — Logs, bolts, or other round sections cut from trees for industrial or consumer uses. (Note: Includes saw logs, veneer logs, and bolts; cooperage logs and bolts; pulpwood; fuelwood; piling; poles; posts; hewn ties; mine timbers; and various other round, split, or hewn products.)

Salvable dead trees. — Standing or down dead trees that are considered merchantable by Regional standards.

Saplings. — Live trees 1.0 inch to 5.0 inches d.b.h.

Sapling-seedling stands. — (See stand-size class.)

Saw log. — A log meeting minimum standards of diameter, length, and defect, including logs at least 8 feet long, sound and straight, and with a minimum diameter outside bark (d.o.b.) for softwoods of 7 inches (9 inches for hardwoods) or other combinations of size and defect specified by Regional standards.

Saw log portion. — That part of the bole of sawtimber trees between the stump and the saw log top at 9.0 d.o.b. for hardwoods and 7.0 d.o.b. for softwoods whenever they are present. (Does not refer to sections meeting minimum log grade specifications.)

Saw log top. — The point on the bole of sawtimber trees above which a saw log cannot be produced. The minimum saw log top is 7.0 inches d.o.b. for softwoods and 9.0 inches d.o.b. for hardwoods.

Sawtimber stands. — (See stand-size class.)

Sawtimber trees. — Live trees of commercial species containing at least a 12-foot saw log or two saw logs 8 feet or longer and meeting Regional specifications for freedom from defect. Softwoods must be at least 9.0 inches d.b.h. Hardwoods must be at least 11.0 inches in diameter.

Sawtimber volume. — Net volume of the saw log portion of live sawtimber in board feet (International 1/4-inch rule).

Seedlings. — Live trees less than 1.0 inch d.b.h. that are expected to survive.

Shelterbelt. — Planted stands of trees either less than 120 feet wide or smaller than 1 acre or both.

Short-log (rough tree). — Sawtimber-size trees of commercial species that contain at least one merchantable 8- to 11-foot saw log but not a 12-foot saw log.

Shrub biomass. — The total above-ground volume (including the bark) of selected shrubs and trees less than 1 inch d.b.h.

Site class. — A classification of forest land in terms of inherent capacity to grow crops of industrial wood based on fully stocked natural stands.

Site index. — An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Softwoods. — Coniferous trees, usually evergreen, having needles or scale-like leaves.

Stand. — A growth of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

Stand-age class. — Age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Stand-area class. — The extent of a continuous forested area of the same forest type, stand-size class, and stand-density class.

Stand-size class. — A classification of forest land based on the size class of growing-stock trees on the area; that is, sawtimber, poletimber, or seedlings and saplings. (Note: Only those trees that contribute to no more than 16 percent stocking at a plot point will be considered in determining stand-size class.)

a. *Sawtimber stands.* — Stands at least 16.7 percent stocked with growing-stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

b. *Poletimber stands.* — Stands at least 16.7 percent stocked with growing-stock trees of which half or more of this stocking is in poletimber and/or sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

c. *Sapling-seedling stands.* — Stands at least 16.7 percent stocked with growing-stock trees of which more than half of the stocking is saplings and/or seedlings.

d. *Nonstocked stands.* — Stands in which stocking of growing-stock trees is less than 16.7 percent.

Stand-volume class. — The amount of sawtimber (in board feet) per acre of commercial forest land.

State land. — Land owned by States, or land leased to these governmental units for 50 years or more.

Stocking. — The degree of occupancy of land by trees, measured by basal area and/or the number of trees in a stand by size or age and spacing, compared to the basal area and/or number of trees required to fully utilize the growth potential of the land; that is, the stocking standard. (Note: Also see stocking explanation in section 21.5 of Forest Survey Handbook.)

Timber removals from growing stock. — The volume of sound wood in growing-stock trees removed annually for forest products (including roundwood products and logging residues) and for other removals.

Timber removals from sawtimber. — The net board-foot volume of live trees removed for forest products annually (including roundwood products and logging residues) and for other removals.

Timber products output. — All timber products cut from roundwood and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees and cull trees.

Tree biomass. — The total aboveground volume (including the bark) of all trees 1 to 5 inches d.b.h. and the total aboveground volume (including the bark) from a 1-foot stump for trees more than 5 inches in diameter.

Tree size class. — A classification of trees based on diameter at breast height, including sawtimber trees, poletimber trees, saplings, and seedlings.

Unproductive forest land. — Forest land incapable of producing 20 cubic feet per acre of industrial wood because of adverse site conditions. (Note: Adverse conditions include sterile soils, dry climate, poor drainage, high elevation steepness, and rockiness.)

Unproductive-reserved forest land. — Unproductive forest land withdrawn from timber utilization through statute, administration, or designation.

Upper stem portion. — That part of the bole of a sawtimber tree above the saw log top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Urban and other areas. — Areas within the legal boundaries of cities and towns; suburban areas developed for residential, industrial, or recreational purposes; schoolyards, cemeteries, roads; railroads; airports; beaches; powerlines; other rights-of-way; or other nonforest land not included in any other specified land use class.

Water. — (a) *Bureau of the Census.* — Streams, sloughs, estuaries, and canals more than one-eighth of a statute mile wide; lakes, reservoirs, and ponds more than 40 acres in area.

(b) *Noncensus.* — The same as the Bureau of the Census, except minimum width of streams, etc., is 120 feet and minimum size of lakes, etc., is 1 acre.

Windbreak. — Planted or natural stand of trees more than 120 feet wide or larger than 1 acre used for the protection of buildings.

Wooded pasture. — Improved pasture with more than 16.7 percent stocking in all trees but less than 25 percent stocking in growing-stock trees. Area currently improved for grazing or shows other evidence of grazing.

Wooded strip. — An acre or more of natural continuous forest land that would otherwise meet survey standards for commercial forest land except that it is less than 120 feet wide.

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(In thousand acres)

Land class	All units	East Unit	West Unit
FOREST LAND			
Commercial	343.2	283.7	59.5
Unproductive	148.0	49.2	98.8
Productive-reserved	4.5	1.5	3.0
Unproductive-reserved	22.4	0.4	22.0
Total	518.1	334.8	183.3
NONFOREST LAND			
Nonforest with trees			
Reserved areas	78.0	1.3	76.7
Cropland	44.6	34.7	9.9
Improved pasture[1/]	436.6	44.6	392.0
Wooded strips[2/]	167.0	47.0	120.0
Idle farmland	9.8	4.9	4.9
Marsh	14.0	2.5	11.5
Windbreaks[3/]	30.1	23.4	6.7
Shelterbelts[4/]	187.3	135.8	51.5
Wooded pasture[1/]	18.3	13.8	4.5
Subtotal	985.7	308.0	677.7
Nonforest without trees			
Cropland	30,545.8	18,065.4	12,480.4
Improved pasture[1/]	10,121.1	2,259.9	7,861.2
Idle farmland	14.9	5.0	9.9
Marsh	968.9	637.0	331.9
Other farm-farmstead	215.4	94.1	121.3
Urban and other	889.5	466.6	422.9
Noncensus water	79.9	37.5	42.4
Subtotal	42,835.5	21,565.5	21,270.0
Total	43,821.2	21,873.5	21,947.7
TOTAL LAND	[5/]44,339.3	22,208.3	22,131.0
WATER (BUREAU OF THE CENSUS)	[5/]895.8	280.1	615.7
TOTAL LAND AND WATER	45,235.1	22,488.4	22,746.7

[1/]Includes areas classified as range by the USDA Soil Conservation Service.

[2/]An acre or more of natural continuous forest land less than 120 feet wide that would otherwise meet survey standards.

[3/]Planted or natural stand of trees more than 120 feet wide or larger than 1 acre used for protecting buildings.

[4/]Planted stands of trees less than 120 feet wide or smaller than 1 acre or both.

[5/]U.S. Department of Commerce, Bureau of the Census. 1970. Area Measurement reports, GE 20, No. 1, 22 p.

Table 7.--Area of land and forest land by county,
North Dakota, 1980

EAST UNIT

County	Land area[1/]	Forest land			Percent commercial forest
		All forest	Non-commercial	Commercial	
	-Thousand acres-				
Barnes	946.6	6.5	1.9	4.6	0.5
Benson	897.7	31.4	3.4	28.0	3.1
Bottineau	1,073.4	44.3	2.3	42.0	3.9
Cass	1,119.3	11.4	2.9	8.5	0.8
Cavalier	967.5	40.2	6.3	33.9	3.5
Dickey	731.6	1.2	0.4	0.8	0.1
Eddy	406.4	3.7	0.9	2.8	0.7
Foster	413.0	0.2	0.1	0.1	--
Grand Forks	920.3	11.0	2.6	8.4	0.9
Griggs	454.3	3.4	0.8	2.6	0.6
Kidder	868.9	--	--	--	--
LaMoure	727.0	1.3	0.4	0.9	0.1
Logan	640.3	0.2	0.1	0.1	--
McHenry	1,202.8	14.3	2.9	11.4	0.9
McIntosh	634.7	0.4	0.2	0.2	--
Nelson	636.9	5.2	1.3	3.9	0.6
Pembina	719.4	31.0	5.7	25.3	3.5
Pierce	664.3	2.1	0.6	1.5	0.2
Ramsey	799.0	2.8	0.4	2.4	0.3
Ransom	551.1	15.9	4.0	11.9	2.2
Richland	927.4	9.0	1.6	7.4	0.8
Rolette	584.0	64.1	4.1	60.0	10.3
Sargent	545.9	1.3	0.5	0.8	0.1
Steele	454.5	3.6	1.1	2.5	0.6
Stutsman	1,449.2	2.8	0.9	1.9	0.1
Towner	667.5	0.1	--	0.1	--
Traill	551.0	8.4	2.4	6.0	1.1
Walsh	823.0	17.6	2.8	14.8	1.8
Wells	831.3	1.4	0.5	0.9	0.1
All counties	22,208.3	334.8	51.1	283.7	1.3

(Table 7 continued on next page)

(Table 7 continued)

WEST UNIT

County	Land area[1/]	Forest land			Percent commercial forest
		All forest	Non-commercial	Commercial	
	- - - - - - - -Thousand acres- - - - - - - - - -				
Adams	633.1	0.1	0.1	--	--
Billings	729.0	17.2	13.7	3.5	0.5
Bowman	748.7	0.5	0.3	0.2	--
Burke	716.0	0.7	0.2	0.5	0.1
Burleigh	1,040.2	7.8	2.7	5.1	0.5
Divide	831.8	0.3	0.1	0.2	--
Dunn	1,275.0	37.9	26.4	11.5	0.9
Emmons	962.0	5.1	2.2	2.9	0.3
Golden Valley	649.0	2.4	1.1	1.3	0.2
Grant	1,066.1	2.9	1.9	1.0	0.1
Hettinger	726.0	0.4	0.2	0.2	--
McKenzie	1,750.4	55.1	50.4	4.7	0.3
McLean	1,321.6	7.4	2.6	4.8	0.4
Mercer	666.6	3.0	1.4	1.6	0.2
Morton	1,228.9	6.1	3.2	2.9	0.2
Mountrail	1,164.2	8.7	2.9	5.8	0.5
Oliver	461.3	3.7	2.3	1.4	0.3
Renville	567.2	0.9	0.4	0.5	0.1
Slope	783.8	7.5	5.0	2.5	0.3
Sheridan	632.7	0.4	0.2	0.2	--
Sioux	704.8	2.2	0.6	1.6	0.2
Stark	842.3	4.2	1.4	2.8	0.3
Ward	1,308.2	5.4	2.0	3.4	0.3
Williams	1,321.1	3.4	2.5	0.9	0.1
All counties	22,131.0	183.3	123.8	59.5	0.3
All units	44,339.3	518.1	174.9	343.2	0.8

[1/] U.S. Department of Commerce, Bureau of the Census. 1970. Area measurement reports, GE-20, No. 1, 22 p.

Table 8.--Area of commercial forest land by ownership class and Forest Survey Unit, North Dakota, 1980

(In thousand acres)

Ownership class	All units	East Unit	West Unit
National Forest	4.7	2.3	2.4
Miscellaneous federal	11.6	7.1	4.5
Indian	33.5	33.5	--
State	21.5	21.5	--
County and municipal	1.7	1.7	--
Farmer	261.6	212.4	49.2
Miscellaneous private	8.6	5.2	3.4
All owners	343.2	283.7	59.5

Table 9.--Area of commercial forest land by ownership class and forest type, North Dakota, 1980

(In thousand acres)

Ownership class	All types	Forest type						
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocke
National Forest	4.7	--	2.3	--	2.4	--	--	--
Miscellaneous federal	11.6	--	--	4.5	--	--	7.1	--
Indian	33.5	--	5.0	5.0	--	2.3	17.8	3.4
State	21.5	--	--	--	--	--	21.5	--
County and municipal	1.7	--	1.7	--	--	--	--	--
Farmer	261.6	2.1	34.1	100.8	14.6	13.5	90.7	5.8
Miscellaneous private	8.6	--	1.1	3.4	1.7	--	2.4	--
All owners	343.2	2.1	44.2	113.7	18.7	15.8	139.5	9.2

Table 10.--Area of commercial forest land by ownership class and site class, North Dakota, 1980

(In thousand acres)

Ownership class	All classes	Site class (cubic feet of growth/acre/year)			
		119+	85-119	50-84	20-49
National Forest	4.7	--	--	--	4.7
Miscellaneous federal	11.6	--	--	--	11.6
Indian	33.5	--	--	10.2	23.3
State	21.5	--	--	21.5	--
County and municipal	1.7	--	--	--	1.7
Farmer	261.6	--	15.7	78.5	167.4
Miscellaneous private	8.6	--	--	2.5	6.1
All owners	343.2	--	15.7	112.7	214.8

Table 11.--Area of commercial forest land by ownership class and ownership size class, North Dakota, 1980

(In thousand acres)

Ownership class	Total	Ownership size class (acres)								
		1-5	5-10	10-20	20-50	50-100	100-500	500-2,500	2,500-5,000	5,000+
National Forest	4.7	--	--	--	--	--	--	--	4.7	--
Miscellaneous federal	11.6	--	--	--	--	--	--	--	--	11.6
Indian	33.5	--	--	--	--	--	--	--	--	33.5
State	21.5	--	--	--	--	--	--	--	--	21.5
County and municipal	1.7	--	--	--	--	--	--	1.7	--	--
Farmer	261.6	104.9	16.6	30.2	26.7	22.3	57.5	3.4	--	--
Miscellaneous private	8.6	4.1	--	1.7	1.7	--	1.1	--	--	--
All owners	343.2	109.0	16.6	31.9	28.4	22.3	58.6	5.1	4.7	66.6

Table 12.--Area of commercial forest land by ownership class, stand-size class, and Forest Survey Unit, North Dakota, 1980

(In thousand acres)

Ownership class	All stands	Stand-size class			
		Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
ALL UNITS					
National Forest	4.7	--	--	4.7	--
Miscellaneous federal	11.6	--	4.0	7.6	--
Indian	33.5	--	22.5	7.6	3.4
State	21.5	2.6	11.5	7.4	--
County and municipal	1.7	--	1.7	--	--
Farmer	261.6	89.9	106.5	59.4	5.8
Miscellaneous private	8.6	5.0	3.6	--	--
All owners	343.2	97.5	149.8	86.7	9.2
EAST UNIT					
National Forest	2.3	--	--	2.3	--
Miscellaneous federal	7.1	--	2.5	4.6	--
Indian	33.5	--	22.5	7.6	3.4
State	21.5	2.6	11.5	7.4	--
County and municipal	1.7	--	1.7	--	--
Farmer	212.4	77.8	91.5	42.0	1.1
Miscellaneous private	5.2	1.6	3.6	--	--
All owners	283.7	82.0	133.3	63.9	4.5
WEST UNIT					
National Forest	2.4	--	--	2.4	--
Miscellaneous federal	4.5	--	1.5	3.0	--
Indian	--	--	--	--	--
State	--	--	--	--	--
County and municipal	--	--	--	--	--
Farmer	49.2	12.1	15.0	17.4	4.7
Miscellaneous private	3.4	3.4	--	--	--
All owners	59.5	15.5	16.5	22.8	4.7

Table 13.--Area of commercial forest land by ownership class and area-condition class, North Dakota, 1980

(In thousand acres)

Ownership class	All classes	Area-condition class			
		70	60	50	40 or better
National Forest	4.7	2.4	2.3	--	--
Miscellaneous federal	11.6	6.3	2.3	3.0	--
Indian	33.5	20.7	12.8	--	--
State	21.5	5.1	13.8	2.6	--
County and municipal	1.7	--	1.7	--	--
Farmer	261.6	128.2	104.0	29.4	--
Miscellaneous private	8.6	8.6	--	--	--
All owners	343.2	171.3	136.9	35.0	--

Table 14.--Area of commercial forest land by ownership class and stand-volume class, North Dakota, 1980

(In thousand acres)

Ownership class	All classes	Stand-volume class (board feet[1] per acre)		
		Less than 1,500	1,500 to 5,000	5,000+
National Forest	4.7	4.7	--	--
Miscellaneous federal	11.6	8.6	3.0	--
Indian	33.5	33.5	--	--
State	21.5	12.5	9.0	--
County and municipal	1.7	--	1.7	--
Farmer	261.6	164.6	80.0	17.0
Miscellaneous private	8.6	5.2	3.4	--
All owners	343.2	229.1	97.1	17.0

[1]/International 1/4-inch rule.

Table 15.--Area of commercial forest land by county and forest type, North Dakota, 1980

(In thousand acres)

EAST UNIT

County	All types	Forest type						
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocked
Barnes	4.6	--	0.2	2.8	0.2	0.6	0.8	--
Benson	28.0	--	6.3	4.6	--	1.1	14.9	1.1
Bottineau	42.0	--	2.9	4.2	--	0.5	34.0	0.4
Cass	8.5	--	0.8	5.2	0.2	1.0	1.3	--
Cavalier	33.9	--	2.8	13.6	0.3	2.1	15.1	--
Dickey	0.8	--	0.1	0.5	--	0.1	0.1	--
Eddy	2.8	--	0.6	1.3	--	0.2	0.6	0.1
Foster	0.2	--	--	0.2	--	--	--	--
Grand Forks	8.3	--	1.1	4.9	0.1	0.8	1.4	--
Griggs	2.6	--	0.3	1.6	--	0.3	0.4	--
Kidder	--	--	--	--	--	--	--	--
LaMoure	0.9	--	0.1	0.6	--	0.1	0.1	--
Logan	0.1	--	--	0.1	--	--	--	--
McHenry	11.3	--	1.9	6.5	0.2	1.1	1.5	0.1
McIntosh	0.2	--	--	0.2	--	--	--	--
Nelson	3.9	--	0.5	2.5	0.1	0.4	0.4	--
Pembina	25.4	--	7.4	6.4	0.2	2.1	7.9	1.4
Pierce	1.6	--	0.2	1.0	--	0.2	0.2	--
Ramsey	2.4	--	0.4	0.8	--	0.1	1.0	0.1
Ransom	11.8	--	3.4	5.8	0.2	1.0	1.4	--
Richland	7.4	--	1.1	4.7	0.1	0.6	0.9	--
Rolette	59.9	--	5.7	6.2	--	0.8	46.1	1.1
Sargent	0.9	--	--	0.5	--	0.1	0.3	--
Steele	2.6	--	0.1	1.6	0.2	0.3	0.4	--
Stutsman	1.9	--	0.1	1.1	0.1	0.3	0.3	--
Towner	0.1	--	--	0.1	--	--	--	--
Traill	6.0	--	0.4	3.6	0.2	0.8	1.0	--
Walsh	14.7	--	3.0	7.2	0.2	1.1	3.0	0.2
Wells	0.9	--	0.1	0.6	--	0.1	0.1	--
All counties	283.7	--	39.5	88.4	2.3	15.8	133.2	4.5

WEST UNIT

County	All types	Forest type						
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocked
Adams	0.1	--	--	0.1	--	--	--	--
Billings	3.5	--	0.2	1.4	1.5	--	0.2	0.2
Bowman	0.2	--	--	0.1	0.1	--	--	--
Burke	0.5	--	--	0.3	0.2	--	--	--
Burleigh	5.1	--	0.4	2.2	1.9	--	0.2	0.4
Divide	0.2	--	--	0.1	0.1	--	--	--
Dunn	11.6	0.2	1.4	3.2	1.9	--	3.5	1.4
Emmons	2.9	--	0.2	1.2	1.2	--	0.1	0.2
Golden Valley	1.3	--	--	0.8	0.4	--	--	0.1
Grant	1.0	--	0.1	0.4	0.3	--	--	0.2
Hettinger	0.2	--	--	0.1	0.1	--	--	--
McKenzie	4.7	0.2	0.1	1.4	1.9	--	1.0	0.1
McLean	4.8	--	0.6	2.3	1.2	--	0.3	0.4
Mercer	1.6	--	0.2	0.7	0.4	--	0.1	0.2
Morton	2.9	--	0.3	1.5	0.7	--	0.1	0.3
Mountrail	5.6	--	0.4	3.3	1.2	--	0.3	0.4
Oliver	1.4	--	0.2	0.7	0.3	--	--	0.2
Renville	0.5	--	--	0.3	0.1	--	0.1	--
Slope	2.5	1.7	--	0.2	0.5	--	0.1	--
Sheridan	0.1	--	--	0.1	--	--	--	--
Sioux	1.6	--	0.1	1.2	0.2	--	--	0.1
Stark	2.8	--	0.2	1.7	0.6	--	0.1	0.2
Ward	3.4	--	0.2	1.4	1.4	--	0.2	0.2
Williams	1.0	--	0.1	0.6	0.2	--	--	0.1
All countis	59.5	2.1	4.7	25.3	16.4	--	6.3	4.7
All units	343.2	2.1	44.2	113.7	18.7	15.8	139.5	9.2

Table 16.--Area of commercial forest land by forest type and stand-age class, North Dakota, 1980

(In thousand acres)

Forest type	All classes	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Ponderosa pine	2.1	--	--	--	--	--	--	2.1	--	--	--	--	--	--
Oak	44.2	2.3	2.3	--	3.4	7.8	16.2	3.4	4.5	2.6	1.7	--	--	--
Elm-ash	113.7	17.6	13.9	--	2.5	3.6	6.6	10.5	11.3	13.0	8.6	19.9	6.2	--
Cottonwood	18.7	2.5	2.4	--	3.0	2.3	--	--	--	3.3	--	5.2	--	--
Plains hardwoods	15.8	--	--	--	--	--	--	2.3	1.6	4.6	5.0	2.3	--	--
Aspen	139.5	28.8	12.5	6.1	20.2	47.1	14.6	5.0	5.2	--	--	--	--	--
Nonstocked	9.2	7.5	--	--	--	1.7	--	--	--	--	--	--	--	--
All types	343.2	58.7	31.1	6.1	29.1	62.5	37.4	23.3	22.6	23.5	15.3	27.4	6.2	--

Table 17.--Area of commercial forest land by forest type, stand-size class, and Forest Survey Unit, North Dakota, 1980

(In thousand acres)

Forest type	All stands	Stand-size class: Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
ALL UNITS					
Ponderosa pine	2.1	--	2.1	--	--
Oak	44.2	5.0	34.5	4.7	--
Elm-ash	113.7	62.9	19.2	31.6	--
Cottonwood	18.7	10.9	3.0	4.8	--
Plains hardwoods	15.8	13.5	2.3	--	--
Aspen	139.5	5.2	88.7	45.6	--
Nonstocked	9.2	--	--	--	9.2
All types	343.2	97.5	149.8	86.7	9.2
EAST UNIT					
Ponderosa pine	--	--	--	--	--
Oak	39.5	5.0	29.8	4.7	--
Elm-ash	88.4	56.0	14.3	18.1	--
Cottonwood	2.3	2.3	--	--	--
Plains hardwoods	15.8	13.5	2.3	--	--
Aspen	133.2	5.2	86.9	41.1	--
Nonstocked	4.5	--	--	--	4.5
All types	283.7	82.0	133.3	63.9	4.5
WEST UNIT					
Ponderosa pine	2.1	--	2.1	--	--
Oak	4.7	--	4.7	--	--
Elm-ash	25.3	6.9	4.9	13.5	--
Cottonwood	16.4	8.6	3.0	4.8	--
Plains hardwoods	--	--	--	--	--
Aspen	6.3	--	1.8	4.5	--
Nonstocked	4.7	--	--	--	4.7
All types	59.5	15.5	16.5	22.8	4.7

Table 18.--Area of commercial forest land by forest type, stand-size class, and site class, North Dakota, 1980

(In thousand acres)

Forest type and stand-size class	All classes	Site class (Cubic feet of growth/acre/year) 85+	50-84	20-49
Ponderosa pine				
Sawtimber	--	--	--	--
Poletimber	2.1	--	--	2.1
Sapling & seedling	--	--	--	--
All stands	2.1	--	--	2.1
Oak				
Sawtimber	5.0	--	5.0	--
Poletimber	34.5	--	3.4	31.1
Sapling & seedling	4.7	--	2.3	2.4
All stands	44.2	--	10.7	33.5
Elm-ash				
Sawtimber	62.9	3.4	5.6	53.9
Poletimber	19.2	--	1.7	17.5
Sapling & seedling	31.6	--	9.1	22.5
All stands	113.7	3.4	16.4	93.9
Cottonwood				
Sawtimber	10.9	3.4	2.3	5.2
Poletimber	3.0	3.0	--	--
Sapling & seedling	4.8	--	--	4.8
All stands	18.7	6.4	2.3	10.0
Plains hardwoods				
Sawtimber	13.5	--	3.3	10.2
Poletimber	2.3	--	--	2.3
Sapling & seedling	--	--	--	--
All stands	15.8	--	3.3	12.5
Aspen				
Sawtimber	5.2	--	5.2	--
Poletimber	88.7	2.6	60.0	26.1
Sapling & seedling	45.6	3.3	14.8	27.5
All stands	139.5	5.9	80.0	53.6
Nonstocked	9.2	--	--	9.2
All types				
Sawtimber	97.5	6.8	21.4	69.3
Poletimber	149.8	5.6	65.1	79.1
Sapling & seedling	86.7	3.3	26.2	57.2
Nonstocked	9.2	--	--	9.2
All stands	343.2	15.7	112.7	214.8

Table 19.--Area of commercial forest land by forest type, stand-size class, and stocking percent, North Dakota, 1980

(In thousand acres)

Forest type and stand-size class	All classes	Stocking percent of growing-stock trees				
		Less than 18	18-60	61-100	101-133	134+
Ponderosa pine						
Sawtimber	--	--	--	--	--	--
Poletimber	2.1	--	--	2.1	--	--
Sapling & seedling	--	--	--	--	--	--
All stands	2.1	--	--	2.1	--	--
Oak						
Sawtimber	5.0	--	--	3.3	--	1.7
Poletimber	34.5	--	18.8	14.0	--	1.7
Sapling & seedling	4.7	--	2.3	2.4	--	--
All stands	44.2	--	21.1	19.7	--	3.4
Elm-ash						
Sawtimber	62.9	--	39.9	17.4	5.6	--
Poletimber	19.2	--	15.1	4.1	--	--
Sapling & seedling	31.6	--	16.6	12.0	3.0	--
All stands	113.7	--	71.6	33.5	8.6	--
Cottonwood						
Sawtimber	10.9	--	9.2	1.7	--	--
Poletimber	3.0	--	--	3.0	--	--
Sapling & seedling	4.8	--	4.8	--	--	--
All stands	18.7	--	14.0	4.7	--	--
Plains hardwoods						
Sawtimber	13.5	--	4.6	7.2	1.7	--
Poletimber	2.3	--	2.3	--	--	--
Sapling & seedling	--	--	--	--	--	--
All stands	15.8	--	6.9	7.2	1.7	--
Aspen						
Sawtimber	5.2	--	2.6	2.6	--	--
Poletimber	88.7	--	25.3	53.1	10.3	--
Sapling & seedling	45.6	--	22.5	14.7	5.8	2.6
All stands	139.5	--	50.4	70.4	16.1	2.6
Nonstocked	9.2	9.2	--	--	--	--
All types						
Sawtimber	97.5	--	56.3	32.2	7.3	1.7
Poletimber	149.8	--	61.5	76.3	10.3	1.7
Sapling & seedling	86.7	--	46.2	29.1	8.8	2.6
Nonstocked	9.2	9.2	--	--	--	--
All stands	343.2	9.2	164.0	137.6	26.4	6.0

Table 20.--Area of commercial forest land by forest type, site-index class, and Forest Survey Unit, North Dakota, 1980

(In thousand acres)

Forest type	All classes	Site-index class (feet)								
		10-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	90+
ALL UNITS										
Ponderosa pine	2.1	--	--	2.1	--	--	--	--	--	--
Oak	44.2	--	7.6	2.8	17.5	14.0	2.3	--	--	--
Elm-ash	113.7	--	--	31.5	37.0	25.4	14.1	4.0	1.7	--
Cottonwood	18.7	--	--	4.2	4.1	--	1.7	2.3	3.0	3.4
Plains hardwoods	15.8	--	--	5.6	4.6	2.3	3.3	--	--	--
Aspen	139.5	--	--	15.7	15.9	44.8	52.0	11.1	--	--
Nonstocked	9.2	--	--	4.5	1.7	3.0	--	--	--	--
All types	343.2	--	7.6	66.4	80.8	89.5	73.4	17.4	4.7	3.4
EAST UNIT										
Ponderosa pine	--	--	--	--	--	--	--	--	--	--
Oak	39.5	--	5.9	2.8	14.5	14.0	2.3	--	--	--
Elm-ash	88.4	--	--	19.2	27.4	23.7	14.1	2.3	1.7	--
Cottonwood	2.3	--	--	--	--	--	--	2.3	--	--
Plains hardwoods	15.8	--	--	5.6	4.6	2.3	3.3	--	--	--
Aspen	133.2	--	--	13.9	13.2	44.8	50.2	11.1	--	--
Nonstocked	4.5	--	--	4.5	--	--	--	--	--	--
All types	283.7	--	5.9	46.0	59.7	84.8	69.9	15.7	1.7	--
WEST UNIT										
Ponderosa pine	2.1	--	--	2.1	--	--	--	--	--	--
Oak	4.7	--	1.7	--	3.0	--	--	--	--	--
Elm-ash	25.3	--	--	12.3	9.6	1.7	--	1.7	--	--
Cottonwood	16.4	--	--	4.2	4.1	--	1.7	--	3.0	3.4
Plains hardwoods	--	--	--	--	--	--	--	--	--	--
Aspen	6.3	--	--	1.8	2.7	--	1.8	--	--	--
Nonstocked	4.7	--	--	--	1.7	3.0	--	--	--	--
All types	59.5	--	1.7	20.4	21.1	4.7	3.5	1.7	3.0	3.4

Table 21.--Area of commercial forest land by forest type and basal-area class, North Dakota, 1980

(In thousand acres)

Forest type	All classes	Basal-area class (square feet per acre)									
		11-20	21-40	41-60	61-80	81-100	101-120	121-140	141-160	161-180	180+
Ponderosa pine	2.1	--	--	--	--	2.1	--	--	--	--	--
Oak	44.2	--	3.4	10.7	17.0	3.0	3.4	3.4	3.3	--	--
Elm-ash	113.7	4.8	11.3	16.9	27.9	32.0	12.4	3.3	1.7	1.7	1.7
Cottonwood	18.7	2.5	2.3	2.3	5.2	3.0	--	1.7	--	1.7	--
Plains hardwoods	15.8	--	--	2.3	--	6.7	3.4	1.7	1.7	--	--
Aspen	139.5	12.0	10.7	26.2	46.0	31.7	5.2	7.7	--	--	--
Nonstocked	9.2	4.5	3.0	--	1.7	--	--	--	--	--	--
All types	343.2	23.8	30.7	58.4	97.8	78.5	24.4	17.8	6.7	3.4	1.7

Table 22.--Area of commercial forest land by forest type and distance to road, North Dakota, 1980

(In thousand acres)

Forest type	Total	Distance to road (miles)							
		0-1/8	1/8-1/4	1/4-1	1-2 1/2	2 1/2-5	5-10	10-20	20+
Ponderosa pine	2.1	--	--	2.1	--	--	--	--	--
Oak	44.2	15.1	10.2	13.3	2.3	--	--	3.3	--
Elm-ash	113.7	38.6	28.6	42.5	1.7	2.3	--	--	--
Cottonwood	18.7	1.6	4.2	12.9	--	--	--	--	--
Plains hardwoods	15.8	5.6	5.6	4.6	--	--	--	--	--
Aspen	139.5	18.0	36.8	77.3	2.5	--	--	4.9	--
Nonstocked	9.2	1.1	3.0	5.1	--	--	--	--	--
All types	343.2	80.0	88.4	157.8	6.5	2.3	--	8.2	--

Table 23.--Area of commercial forest land by forest type and distance to water, North Dakota, 1980

(In thousand acres)

Forest type	Total	Distance to water (miles)							
		0-1/8	1/8-1/4	1/4-1	1-2 1/2	2 1/2-5	5-10	10-20	20+
Ponderosa pine	2.1	--	--	2.1	--	--	--	--	--
Oak	44.2	1.7	5.0	3.5	7.7	7.1	12.3	4.6	2.3
Elm-ash	113.7	49.0	12.7	12.1	9.1	16.2	9.6	5.0	--
Cottonwood	18.7	4.8	3.0	6.9	1.7	2.3	--	--	--
Plains hardwoods	15.8	6.1	1.7	3.4	2.3	--	--	--	2.3
Aspen	139.5	42.1	16.4	36.1	16.4	7.7	10.5	10.3	--
Nonstocked	9.2	6.4	--	1.1	--	1.7	--	--	--
All types	343.2	110.1	38.8	65.2	37.2	35.0	32.4	19.9	4.6

Table 24.--Area of commercial forest land by forest type and stand area class, North Dakota, 1980

(In thousand acres)

Forest type	All classes	Stand area class (acres)								
		1-4	5-9	10-19	20-39	40-79	159	319	639	640+
Ponderosa pine	2.1	--	--	--	--	--	2.1	--	--	--
Oak	44.2	10.6	3.4	9.4	1.1	10.0	6.7	--	3.0	--
Elm-ash	113.7	43.1	20.7	12.6	12.6	8.9	10.7	--	5.1	--
Cottonwood	18.7	9.4	4.1	--	--	--	5.2	--	--	--
Plains hardwoods	15.8	3.4	2.3	5.6	4.5	--	--	--	--	--
Aspen	139.5	36.2	19.5	14.4	25.8	22.9	10.2	8.9	1.6	--
Nonstocked	9.2	4.7	--	1.1	3.4	--	--	--	--	--
All types	343.2	107.4	50.0	43.1	47.4	41.8	34.9	8.9	9.7	--

Table 25.--Area of commercial forest land by stocking class based on selected stand components, North Dakota, 1980

(In thousand acres)

Stocking percentage	All trees	Stocking classified in terms of: Growing-stock trees	Desirable trees	Acceptable trees	Rough and rotten trees
0-10	--	4.1	339.8	4.1	53.7
11-20	--	11.7	1.7	11.7	46.8
21-30	2.5	22.7	1.7	22.7	72.3
31-40	6.5	31.8	--	33.5	40.1
41-50	3.4	54.4	--	56.9	45.3
51-60	16.6	48.6	--	46.0	30.9
61-70	16.8	41.8	--	43.5	21.1
71-80	38.5	38.7	--	37.0	19.4
81-90	45.0	27.9	--	29.6	5.3
91-100	49.3	29.2	--	25.9	8.3
101-110	45.8	20.1	--	23.1	--
111-120	49.5	4.6	--	3.3	--
121-130	40.0	1.7	--	--	--
131-140	20.0	3.3	--	3.3	--
141-150	9.3	2.6	--	2.6	--
151-160	--	--	--	--	--
161+	--	--	--	--	--
Total	343.2	343.2	343.2	343.2	343.2

Table 26.--Area of noncommercial forest land by forest type and Forest Survey Unit, North Dakota, 1980

(In thousand acres)

Forest type	Total	Unproductive	Forest reserved
ALL UNITS			
Oak	38.7	38.7	--
Elm-ash	107.8	95.3	12.5
Cottonwood	23.0	8.6	14.4
Aspen	5.4	5.4	--
All types	174.9	148.0	26.9
EAST UNIT			
Oak	34.8	34.8	--
Elm-ash	14.6	12.7	1.9
Cottonwood	--	--	--
Aspen	1.7	1.7	--
All types	51.1	49.2	1.9
WEST UNIT			
Oak	3.9	3.9	--
Elm-ash	93.2	82.6	10.6
Cottonwood	23.0	8.6	14.4
Aspen	3.7	3.7	--
All types	123.8	98.8	25.0

Table 27.--Area of nonforest land with trees by land use, forest type, and Forest Survey Unit, North Dakota, 1980

(In thousand acres)

Land use	All types	Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Exotic	Non-stocked
				ALL UNITS					
				Forest type					
Reserved areas	78.0	--	--	37.1	40.9	--	--	--	--
Cropland	44.6	--	2.5	34.7	--	2.5	4.9	--	--
Improved pasture	436.6	7.4	17.3	314.2	85.3	2.5	7.4	--	2.5
Wooded strips	167.0	--	12.0	130.2	2.5	2.5	14.8	2.5	2.5
Idle farmland	9.8	--	--	9.8	--	--	--	--	--
Marsh	14.0	--	--	11.5	--	--	2.5	--	--
Windbreaks	30.1	--	--	27.8	2.3	--	--	--	--
Shelterbelts	187.3	--	--	172.4	--	9.9	--	5.0	--
Wooded pasture	18.3	--	--	8.5	--	2.3	--	--	7.5
All uses	985.7	7.4	31.8	746.2	131.0	19.7	29.6	7.5	12.5
				EAST UNIT					
Reserved areas	1.3	--	--	1.3	--	--	--	--	--
Cropland	34.7	--	2.5	24.8	--	2.5	4.9	--	--
Improved pasture	44.6	--	7.4	24.8	--	2.5	7.4	--	2.5
Wooded strips	47.0	--	5.0	27.1	--	2.5	7.4	2.5	2.5
Idle farmland	4.9	--	--	4.9	--	--	--	--	--
Marsh	2.5	--	--	--	--	--	2.5	--	--
Windbreaks	23.4	--	--	21.1	2.3	--	--	--	--
Shelterbelts	135.8	--	--	120.9	--	9.9	--	5.0	--
Wooded pasture	13.8	--	--	4.0	--	2.3	--	--	7.5
All uses	308.0	--	14.9	228.9	2.3	19.7	22.2	7.5	12.5
				WEST UNIT					
Reserved areas	76.7	--	--	35.8	40.9	--	--	--	--
Cropland	9.9	--	--	9.9	--	--	--	--	--
Improved pasture	392.0	7.4	9.9	289.4	85.3	--	--	--	--
Wooded strips	120.0	--	7.0	103.1	2.5	--	7.4	--	--
Idle farmland	4.9	--	--	4.9	--	--	--	--	--
Marsh	11.5	--	--	11.5	--	--	--	--	--
Windbreaks	6.7	--	--	6.7	--	--	--	--	--
Shelterbelts	51.5	--	--	51.5	--	--	--	--	--
Wooded pasture	4.5	--	--	4.5	--	--	--	--	--
All uses	677.7	7.4	16.9	517.3	128.7	--	7.4	--	--

Table 28.--Area of nonforest land with trees by forest type and stand-size class, North Dakota, 1980

(In thousand acres)

Forest type	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
		Stand-size class			
Ponderosa pine	7.4	--	5.0	2.4	--
Oak	31.8	--	19.5	12.3	--
Elm-ash	746.2	141.4	382.6	222.2	--
Cottonwood	131.0	3.3	33.6	94.1	--
Plains hardwoods	19.7	2.3	9.9	7.5	--
Aspen	29.6	--	10.0	19.6	--
Exotic	7.5	2.5	--	5.0	--
Nonstocked	12.5	--	--	--	12.5
All types	985.7	149.5	460.6	363.1	12.5

Table 29.--Number of all live trees on commercial forest land by species group and diameter class, North Dakota, 1980

(In thousand trees)

Species group	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS															
Ponderosa pine	1,090.6	629.1	--	279.1	112.5	59.7	10.2	--	--	--	--	--	--	--	--
Other softwoods	209.7	209.7	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	1,300.3	838.8	--	279.1	112.5	59.7	10.2	--	--	--	--	--	--	--	--
HARDWOODS															
Oak	27,464.6	9,645.0	9,444.5	3,384.7	2,365.2	1,646.9	510.2	229.5	111.6	79.0	31.2	16.8	--	--	--
Basswood	947.5	--	--	68.9	105.0	159.4	275.8	162.5	70.0	45.8	38.2	2.2	19.7	--	--
Elm	7,372.5	1,972.9	1,692.2	788.0	742.3	533.7	487.3	432.7	297.1	156.6	93.3	60.4	93.6	22.4	--
Ash	27,508.4	10,608.3	8,246.1	3,809.2	2,234.6	1,283.7	713.0	367.0	101.4	82.7	41.1	19.4	1.9	--	--
Cottonwood	3,992.9	1,475.6	978.1	534.6	179.9	289.8	161.3	88.1	24.2	27.7	47.3	37.8	96.8	45.0	6.7
Hackberry	233.6	166.1	--	24.7	23.4	--	9.2	5.8	--	4.4	--	--	--	--	--
Balsam poplar	5,727.8	1,783.0	1,547.2	988.2	801.7	384.2	162.3	38.5	22.7	--	--	--	--	--	--
Aspen	61,188.6	31,238.0	13,564.2	7,950.7	4,591.7	2,622.4	855.9	267.0	83.5	10.6	4.6	--	--	--	--
Birch	3,616.8	1,465.4	673.8	782.7	407.9	140.4	102.9	43.7	--	--	--	--	--	--	--
Boxelder	15,108.9	8,296.9	3,052.0	1,537.7	848.1	580.6	308.0	190.4	152.2	66.0	51.1	10.4	10.7	4.8	--
Other hardwoods	913.9	913.9	--	--	--	--	--	--	--	--	--	--	--	--	--
Noncommercial species	7,245.8	6,523.9	330.3	29.1	84.3	78.3	38.3	55.1	38.1	24.0	14.7	15.3	14.4	--	--
Total	161,321.3	74,089.0	39,528.4	19,898.5	12,384.1	7,719.4	3,624.2	1,880.3	900.8	496.8	321.5	162.3	237.1	72.2	6.7
All species	162,621.6	74,927.8	39,528.4	20,177.6	12,496.6	7,779.1	3,634.4	1,880.3	900.8	496.8	321.5	162.3	237.1	72.2	6.7

Table 30.--Number of growing-stock trees on commercial forest land by species group and diameter class, North Dakota, 1980

(In thousand trees)

Species group	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS															
Ponderosa pine	648.6	209.7	--	279.0	90.0	59.7	10.2	--	--	--	--	--	--	--	--
Total	648.6	209.7	--	279.0	90.0	59.7	10.2	--	--	--	--	--	--	--	--
HARDWOODS															
Oak	19,869.3	8,477.1	6,224.1	1,726.2	1,588.0	1,190.3	310.7	174.4	78.2	62.1	24.0	14.2	--	--	--
Basswood	690.6	--	--	37.2	55.2	135.6	217.4	134.0	42.0	35.6	28.6	2.2	2.8	--	--
Elm	5,266.3	1,972.9	1,521.0	248.1	201.7	333.0	257.2	276.9	197.5	105.9	67.1	23.5	59.1	2.4	--
Ash	19,754.4	10,360.5	4,821.8	2,114.8	1,031.7	640.2	415.4	192.3	61.9	71.0	32.5	10.3	2.0	--	--
Cottonwood	3,629.0	1,475.6	978.2	492.3	117.3	189.5	78.2	79.2	15.5	15.0	44.6	37.8	81.9	23.4	0.5
Hackberry	30.5	--	--	24.7	--	--	--	5.8	--	--	--	--	--	--	--
Balsam poplar	5,320.3	1,783.0	1,299.3	974.5	695.3	384.2	132.0	29.3	22.7	--	--	--	--	--	--
Aspen	52,386.8	28,536.2	11,863.1	6,220.0	3,550.2	1,633.4	401.5	157.3	20.5	--	4.6	--	--	--	--
Birch	3,159.1	1,299.2	673.8	666.1	298.7	98.6	102.9	19.8	--	--	0	--	--	--	--
Boxelder	6,874.9	4,690.2	1,225.3	349.9	330.7	175.7	34.8	12.7	36.2	3.5	12.3	3.6	--	--	--
Other hardwoods	913.9	913.9	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	117,895.1	59,508.6	28,606.6	12,853.8	7,868.8	4,780.5	1,950.1	1,081.7	474.5	293.1	213.7	91.6	145.8	25.8	0.5
All species	118,543.7	59,718.3	28,606.6	13,132.8	7,958.8	4,840.2	1,960.3	1,081.7	474.5	293.1	213.7	91.6	145.8	25.8	0.5

Table 31.--Net volume of timber on commercial forest land by class of timber and softwoods and hardwoods, North Dakota, 1980

(In thousand cubic feet)

Class of timber	All species	Softwoods	Hardwoods
LIVE TREES			
Growing-stock trees			
Sawtimber			
Saw log portion	77,502.2	517.9	76,984.3
Upper stem portion	19,093.3	95.1	18,998.2
Subtotal	96,595.5	613.0	95,982.5
Poletimber	110,519.1	1,081.2	109,437.9
Total growing-stock	207,114.6	1,694.2	205,420.4
Cull trees			
Rough and rotten cull trees			
Sawtimber	33,209.7	--	33,209.7
Poletimber	40,798.0	98.1	40,699.9
Subtotal	74,007.7	98.1	73,909.6
Short-log cull trees	14,981.0	--	14,981.0
Total cull	88,988.7	98.1	88,890.6
TOTAL LIVE TREES	296,103.3	1,792.3	294,311.0
SALVABLE DEAD TREES	6,047.5	--	6,047.5
ALL CLASSES	302,150.8	1,792.3	300,358.5

Table 32.--Net volume of growing stock and sawtimber on commercial forest land by county and species category, North Dakota, 1980

EAST UNIT

County	Growing stock						Sawtimber					
	All species	Softwoods	Elm	Ash	Aspen	Other hardwoods	All species	Softwoods	Elm	Ash	Aspen	Other hardwoods
	Thousand cubic feet						Thousand board feet[1/]					
Barnes	2,350.5	--	741.2	487.0	61.7	1,060.6	9,300.0	--	3,230.2	1,849.3	88.5	4,132.0
Benson	14,633.4	--	1,522.4	1,371.5	6,898.4	4,841.1	20,536.9	--	7,068.2	3,107.4	2,188.3	8,173.0
Bottineau	26,990.0	--	868.5	2,482.0	15,467.0	8,172.5	31,368.4	--	2,874.9	2,040.3	14,624.7	11,828.5
Cass	5,382.5	--	1,538.2	1,241.2	166.9	2,436.2	20,510.0	--	6,651.2	4,430.1	138.6	9,290.1
Cavalier	23,471.3	--	4,087.0	4,392.5	5,966.3	9,025.5	64,482.2	--	17,262.5	12,875.2	6,041.6	28,302.9
Dickey	442.4	--	134.0	96.1	13.3	199.0	1,715.7	--	577.1	349.4	14.6	774.6
Eddy	2,011.6	--	461.2	440.5	209.9	900.0	6,694.2	--	2,114.2	1,600.8	53.4	2,925.8
Foster	143.4	--	36.7	39.1	5.6	62.0	542.3	--	159.3	135.1	1.4	246.5
Grand Forks	5,768.8	--	1,501.8	1,314.9	373.2	2,578.9	20,623.8	--	6,536.9	4,589.4	156.8	9,340.7
Griggs	1,777.9	--	499.7	432.4	60.9	784.9	6,815.9	--	2,158.7	1,530.9	39.4	3,086.9
Kidder	--	--	--	--	--	--	--	--	--	--	--	--
LaMoure	620.6	--	172.5	153.2	21.6	273.3	2,379.4	--	745.7	540.6	12.8	1,080.3
Logan	49.3	--	16.0	9.4	1.3	22.6	193.3	--	68.8	35.3	2.2	87.0
McHenry	8,601.0	--	2,180.0	1,990.4	315.9	4,114.7	30,769.1	--	9,651.0	7,026.7	155.3	13,936.1
McIntosh	100.4	--	32.7	19.1	2.6	46.0	393.9	--	140.2	71.9	4.4	177.4
Nelson	3,048.8	--	803.2	751.8	81.1	1,412.7	11,478.2	--	3,594.2	2,729.0	48.6	5,106.4
Pembina	13,180.6	--	2,219.1	2,160.7	2,432.1	6,368.7	31,310.8	--	9,682.3	6,345.5	534.6	14,748.4
Pierce	1,152.8	--	315.8	290.2	41.1	505.7	4,402.9	--	1,365.8	1,019.5	21.5	1,996.1
Ramsey	1,362.0	--	230.6	185.2	474.4	471.8	2,995.2	--	1,031.1	562.8	123.1	1,278.2
Ransom	6,958.3	--	1,818.1	1,585.9	366.7	3,187.6	24,917.4	--	7,872.4	5,597.2	139.1	11,308.7
Richland	6,102.1	--	1,594.6	1,546.4	181.1	2,780.0	22,997.1	--	7,085.0	5,538.9	87.3	10,285.9
Rolette	36,895.4	--	940.0	2,718.5	23,635.4	9,601.5	38,985.9	--	3,406.1	1,409.3	21,747.5	12,423.0
Sargent	400.0	--	130.2	76.1	10.4	183.3	1,569.3	--	558.8	286.6	17.6	706.3
Steele	1,332.5	--	413.8	277.4	38.3	603.0	5,187.9	--	1,779.6	1,019.6	48.8	2,339.9
Stutsman	936.8	--	295.0	190.1	26.2	425.5	3,655.5	--	1,267.9	703.5	36.3	1,647.8
Towner	50.1	--	16.3	9.5	1.3	23.0	196.4	--	69.9	35.9	2.2	88.4
Traill	3,366.3	--	1,015.3	736.4	102.4	1,512.2	13,044.8	--	4,371.9	2,673.5	108.6	5,890.8
Walsh	11,072.0	--	2,431.7	2,241.9	1,147.9	5,250.5	34,877.0	--	11,146.5	7,925.7	346.4	15,458.4
Wells	545.5	--	157.3	128.0	18.0	242.2	2,099.0	--	678.5	456.9	14.0	949.6
Total	178,746.3	--	26,172.9	27,367.4	58,121.0	67,085.0	414,042.5	--	113,148.9	76,486.3	46,797.6	177,609.7

(Table 32 continued on next page)

(Table 32 continued)

WEST UNIT

County	Growing stock						Sawtimber					
	All species	Softwoods	Elm	Ash	Aspen	Other hardwoods	All species	Softwoods	Elm	Ash	Aspen	Other hardwoods
	Thousand cubic feet						Thousand board feet[1]					
Adams	13.7	--	--	0.6	0.8	12.3	29.3	--	--	2.0	1.8	25.5
Billings	1,680.9	--	56.9	221.2	73.4	1,329.4	6,145.0	--	235.8	399.0	48.5	5,461.7
Bowman	48.9	--	--	2.3	3.1	43.5	116.5	--	--	7.9	7.2	101.4
Burke	180.4	--	28.3	36.8	5.9	109.4	655.7	--	109.9	65.4	--	480.4
Burleigh	3,630.8	--	258.9	346.6	72.5	2,952.8	15,625.9	--	1,012.1	640.5	46.3	13,927.0
Divide	5.5	--	--	--	--	5.5	--	--	--	--	--	--
Dunn	4,544.0	151.0	139.7	389.5	1,023.1	2,840.7	9,960.3	281.0	645.3	716.0	433.3	7,884.7
Emmons	2,286.9	--	78.7	235.1	34.2	1,938.9	9,889.5	--	312.1	432.1	42.9	9,102.4
Golden Valley	268.8	--	30.6	39.9	9.1	189.2	798.5	--	123.3	74.8	7.2	593.2
Grant	301.8	--	4.0	14.2	19.2	264.4	754.3	--	27.4	49.2	44.8	632.9
Hettinger	27.2	--	--	1.1	1.5	24.6	58.3	--	--	4.0	3.6	50.7
McKenzie	1,801.1	157.5	61.4	587.4	157.4	837.4	4,688.6	293.0	245.2	1,017.8	18.4	3,114.2
McLean	2,628.4	--	269.3	357.1	73.0	1,929.0	10,409.6	--	1,057.7	657.2	42.5	8,652.2
Mercer	715.5	--	85.7	120.3	30.0	479.5	2,445.2	--	332.0	229.1	28.6	1,855.5
Morton	1,199.8	--	114.1	171.3	54.9	859.5	3,825.8	--	442.0	343.7	73.1	2,967.0
Mountrail	2,238.7	--	306.7	407.0	82.8	1,442.2	7,783.5	--	1,202.9	748.5	47.5	5,784.6
Oliver	455.1	--	12.6	30.7	26.9	384.9	1,184.1	--	58.1	85.7	58.2	982.1
Renville	174.6	--	19.5	27.6	7.2	120.3	569.5	--	75.5	53.0	7.3	433.7
Slope	1,487.4	1,385.7	9.6	12.5	2.0	77.6	2,801.0	2,578.5	37.3	22.2	--	163.0
Sheridan	25.6	--	0.8	1.1	1.5	22.2	63.4	--	5.5	3.9	3.6	50.4
Sioux	422.0	--	50.7	67.2	14.9	289.2	1,324.9	--	201.3	125.3	11.0	987.3
Stark	1,239.9	--	137.5	426.2	37.6	638.6	3,911.3	--	544.7	752.3	23.3	2,591.0
Ward	2,637.9	--	172.9	232.0	45.8	2,187.2	11,639.6	--	670.2	424.8	23.4	10,521.2
Williams	353.4	--	47.6	64.1	12.9	228.8	1,216.6	--	184.4	117.7	7.1	907.4
Total	28,368.3	1,694.2	1,885.5	3,791.8	1,789.7	19,207.1	95,896.4	3,152.5	7,522.7	6,972.1	979.6	77,269.5
All units	207,114.6	1,694.2	28,058.4	31,159.2	59,910.7	86,292.1	509,938.9	3,152.5	120,671.6	83,458.4	447,777.2	254,879.2

[1] International 1/4-inch rule.

Table 33.--Net volume of growing-stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species, North Dakota, 1980

Species	Total all live	Growing stock	Short-log	Rough and rotten	Sawtimber
	- - - - - - - -	-Thousand cubic feet-		- - - - - - - -	Thousand board feet[1/]
SOFTWOODS					
Ponderosa pine	1,792.3	1,694.2	--	98.1	3,152.5
Total	1,792.3	1,694.2	--	98.1	3,152.5
HARDWOODS					
Boxelder	18,968.6	5,320.7	2,019.1	11,628.8	9,456.7
River birch	74.9	--	--	74.9	--
Paper birch	7,141.1	6,038.3	335.1	767.7	9,303.7
Hackberry	343.4	178.6	98.0	66.8	621.7
Black ash	932.6	118.8	--	813.8	--
Green ash	46,814.4	31,040.4	1,518.5	14,255.5	83,458.4
Balsam poplar	12,599.7	12,006.8	136.2	456.7	13,510.6
Eastern cottonwood	22,636.1	17,038.5	1,834.8	3,762.8	73,058.2
Plains cottonwood	7,399.1	6,359.4	637.6	402.1	32,729.4
Quaking aspen	76,658.4	59,910.7	489.8	16,257.9	47,777.2
Bur oak	39,935.6	29,229.6	1,749.7	8,956.3	66,082.6
American basswood	11,971.3	10,120.2	406.1	1,445.0	50,116.3
American elm	44,019.9	27,861.3	5,756.1	10,402.5	120,671.6
Slippery elm	197.1	197.1	--	--	--
Noncommercial species	4,618.8	--	--	4,618.8	--
Total	294,311.0	205,420.4	14,981.0	73,909.6	506,786.4
All species	296,103.3	207,114.6	14,981.0	74,007.7	509,938.9

[1/] International 1/4-inch rule.

Table 34.--Net volume of growing stock on commercial forest land by species group and diameter class, North Dakota, 1980

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS													
Ponderosa pine	1,694.2	626.6	454.7	483.0	129.9	--	--	--	--	--	--	--	--
Total	1,694.2	626.6	454.7	483.0	129.9	--	--	--	--	--	--	--	--
HARDWOODS													
Oak	29,229.6	2,923.9	6,418.0	8,487.2	3,387.0	2,786.5	1,658.0	1,874.5	1,002.3	692.2	--	--	--
Basswood	10,120.2	51.5	286.7	957.5	2,843.0	2,503.6	959.2	1,119.9	1,131.2	115.1	152.5	--	--
Elm	28,058.4	408.0	949.2	2,716.2	3,270.4	4,711.1	4,755.7	3,189.5	2,675.8	1,183.6	3,894.7	304.2	--
Ash	31,159.2	4,608.7	5,182.5	5,547.7	5,581.1	3,908.7	1,852.9	2,259.5	1,546.3	552.3	119.5	--	--
Cottonwood	23,397.9	993.8	737.7	1,477.9	1,106.1	1,599.8	473.3	605.3	1,965.6	2,354.6	8,306.5	3,644.5	132.8
Hackberry	178.6	54.2	--	--	--	124.4	--	--	--	--	--	--	--
Balsam poplar	12,006.8	2,187.2	3,548.4	3,424.5	1,595.3	499.7	751.7	--	--	--	--	--	--
Aspen	59,910.7	15,873.9	19,289.4	15,605.7	5,422.0	2,981.9	531.9	--	205.9	--	--	--	--
Birch	6,038.3	1,887.3	1,524.8	918.6	1,268.6	439.0	--	--	--	--	--	--	--
Boxelder	5,320.7	819.2	1,424.3	1,133.7	418.9	201.9	608.4	90.1	513.4	110.8	--	--	--
Total	205,420.4	29,807.7	39,361.0	40,269.0	24,892.4	19,756.6	11,591.1	9,138.8	9,040.5	5,008.6	12,473.2	3,948.7	132.8
All species	207,114.6	30,434.3	39,815.7	40,752.0	25,022.3	19,756.6	11,591.1	9,138.8	9,040.5	5,008.6	12,473.2	3,948.7	132.8

Table 35.--Net volume of sawtimber on commercial forest land by species group and diameter class, North Dakota, 1980

(In thousand board feet)[1/]

Species group	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS											
Ponderosa pine	3,152.5	2,562.9	589.6	--	--	--	--	--	--	--	--
Total	3,152.5	2,562.9	589.6	--	--	--	--	--	--	--	--
HARDWOODS											
Oak	66,082.6	--	20,198.7	16,304.3	9,177.1	10,862.6	5,976.0	3,563.9	--	--	--
Basswood	50,116.3	--	15,101.0	14,950.1	5,375.7	6,594.1	7,033.7	658.1	403.6	--	--
Elm	120,671.6	--	16,309.8	23,903.8	23,198.2	16,621.3	12,911.1	5,917.4	19,847.1	1,962.9	--
Ash	83,458.4	--	28,664.5	20,057.6	10,752.7	11,452.7	8,482.5	3,399.7	648.7	--	--
Cottonwood	105,787.6	--	5,409.4	7,931.9	2,584.0	3,334.1	11,150.9	13,069.8	43,918.4	17,656.6	732.5
Hackberry	621.7	--	--	621.7	--	--	--	--	--	--	--
Balsam poplar	13,510.6	--	7,668.6	2,744.2	3,097.8	--	--	--	--	--	--
Aspen	47,777.2	--	27,450.2	15,609.3	3,490.0	--	1,227.7	--	--	--	--
Birch	9,303.7	--	6,716.4	2,587.3	--	--	--	--	--	--	--
Boxelder	9,456.7	--	2,082.0	1,001.5	3,242.8	465.2	2,405.2	260.0	--	--	--
Total	506,786.4	--	129,600.6	105,711.7	60,918.3	49,330.0	49,187.1	26,868.9	64,817.8	19,619.5	732.5
All species	509,938.9	2,562.9	130,190.2	105,711.7	60,918.3	49,330.0	49,187.1	26,868.9	64,817.8	19,619.5	732.5

[1/] International 1/4-inch rule.

Table 36.--Net volume of growing stock on commercial forest land by species group and ownership class, North Dakota, 1980

(In thousand cubic feet)

Species group	All owners	Ownership class						
		National Forest	Misc. federal	Indian	State	County & municipal	Farmer	Misc. private
SOFTWOODS								
Ponderosa pine	1,694.2	--	--	--	--	--	1,694.2	--
Total	1,694.2	--	--	--	--	--	1,694.2	--
HARDWOODS								
Oak	29,229.6	229.6	--	1,170.1	732.6	884.2	25,429.0	784.1
Basswood	10,120.2	--	--	115.8	--	--	10,004.4	--
Elm	28,058.4	--	--	747.9	--	115.4	26,413.3	781.8
Ash	31,159.2	--	1,005.5	670.1	1,288.1	--	27,478.1	717.4
Cottonwood	23,397.9	259.9	1,414.2	--	--	--	20,567.7	1,156.1
Hackberry	178.6	--	--	--	--	--	178.6	--
Balsam poplar	12,006.8	--	985.0	415.6	2,673.0	--	7,466.2	467.0
Aspen	59,910.7	135.1	1,058.8	7,100.1	9,708.7	--	41,078.5	829.5
Birch	6,038.3	--	--	--	2,214.5	--	3,778.6	45.2
Boxelder	5,320.7	--	--	--	--	--	5,320.7	--
Total	205,420.4	624.6	4,463.5	10,219.6	16,616.9	999.6	167,715.1	4,781.1
All species	207,114.6	624.6	4,463.5	10,219.6	16,616.9	999.6	169,409.3	4,781.1

Table 37.--Net volume of sawtimber on commercial forest land by species group and ownership class, North Dakota, 1980

(In thousand board feet)[1/]

Species group	All owners	Ownership class					
		Misc. federal	Indian	State	County & municipal	Farmer	Misc. private
SOFTWOODS							
Ponderosa pine	3,152.5	--	--	--	--	3,152.5	--
Total	3,152.5	--	--	--	--	3,152.5	--
HARDWOODS							
Oak	66,082.6	--	--	2,611.6	727.2	59,602.5	3,141.3
Basswood	50,116.3	--	741.7	--	--	49,374.6	--
Elm	120,671.6	--	4,294.6	--	--	112,732.8	3,644.2
Ash	83,458.4	1,715.5	641.7	--	--	78,653.2	2,448.0
Cottonwood	105,787.6	8,235.7	--	--	--	91,238.7	6,313.2
Hackberry	621.7	--	--	--	--	621.7	--
Balsam poplar	13,510.6	643.4	--	--	2,754.4	10,112.8	--
Aspen	47,777.2	1,433.3	1,152.6	--	13,744.1	31,447.2	--
Birch	9,303.7	--	--	--	6,181.0	3,122.7	--
Boxelder	9,456.7	--	--	--	--	9,456.7	--
Total	506,786.4	12,027.9	6,830.6	2,611.6	23,406.7	446,362.9	15,546.7
All species	509,938.9	12,027.9	6,830.6	2,611.6	23,406.7	449,515.4	15,546.7

[1/]International 1/4-inch rule.

Table 38.--Net volume of growing stock on commercial forest land by forest type and stand-age class, North Dakota, 1980

(In thousand cubic feet)

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Ponderosa pine	1,694.2	--	--	--	--	--	--	1,694.2	--	--	--	--	--	--
Oak	26,368.4	364.8	730.9	--	1,036.5	2,706.2	9,168.3	5,434.2	2,230.9	1,209.8	3,486.8	--	--	--
Elm-ash	65,557.2	5,276.7	704.0	--	3,170.0	1,887.4	1,926.8	9,390.0	5,935.2	11,989.2	5,706.9	15,202.7	4,368.3	--
Cottonwood	16,759.7	77.3	259.9	--	3,698.6	1,926.1	--	--	--	3,282.3	--	7,515.5	--	--
Plains hardwoods	16,651.4	--	--	--	--	--	--	588.3	3,286.2	3,762.0	7,624.6	1,390.3	--	--
Aspen	80,012.2	3,958.6	1,897.6	1,433.2	12,634.4	36,698.1	13,761.4	5,129.1	4,499.8	--	--	--	--	--
Nonstocked	71.5	--	--	--	--	71.5	--	--	--	--	--	--	--	--
All types	207,114.6	9,677.4	3,592.4	1,433.2	20,539.5	43,289.3	24,856.5	22,235.8	15,952.1	20,243.3	16,818.3	24,108.5	4,368.3	--

Table 39.--Net volume of sawtimber on commercial forest land by forest type and stand-age class, North Dakota, 1980

(In thousand board feet)[1/]

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Ponderosa pine	3,152.5	--	--	--	--	--	--	3,152.5	--	--	--	--	--	--
Oak	46,866.2	--	--	--	--	1,777.6	14,744.5	12,173.9	3,296.1	569.9	14,304.2	--	--	--
Elm-ash	245,939.3	22,941.0	2,086.3	--	4,004.1	3,722.1	1,152.8	30,887.6	19,224.4	46,494.1	22,421.0	70,468.3	22,537.6	--
Cottonwood	69,794.3	--	--	--	5,616.0	9,648.6	--	--	--	15,487.1	--	39,042.6	--	--
Plains hardwood	75,605.7	--	--	--	--	--	--	1,383.4	18,825.0	17,902.0	33,268.3	4,227.0	--	--
Aspen	68,580.9	1,754.6	1,693.9	771.8	5,163.7	24,533.4	14,848.1	5,094.0	14,721.4	--	--	--	--	--
Nonstocked	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All types	509,938.9	24,695.6	3,780.2	771.8	14,783.8	39,681.7	30,745.4	52,691.4	56,066.9	80,453.1	69,993.5	113,737.9	22,537.6	--

[1/] International 1/4-inch rule.

Table 40.--Net volume of growing stock on commercial forest land by species group and forest type, North Dakota, 1980

(In thousand cubic feet)

Species group	All types	Forest type						
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocked
SOFTWOODS								
Ponderosa pine	1,694.2	1,694.2	--	--	--	--	--	--
Total	1,694.2	1,694.2	--	--	--	--	--	--
HARDWOODS								
Oak	29,229.6	--	17,284.3	5,470.4	--	3,799.1	2,675.8	--
Basswood	10,120.2	--	2,321.5	699.5	--	7,099.2	--	--
Elm	28,058.4	--	1,335.4	21,650.7	198.5	4,040.3	833.5	--
Ash	31,159.2	--	3,221.9	23,390.6	76.1	1,212.4	3,186.7	71.5
Cottonwood	23,397.9	--	--	7,165.0	16,232.9	--	--	--
Hackberry	178.6	--	--	178.6	--	--	--	--
Balsam poplar	12,006.8	--	165.4	1,672.6	--	--	10,168.8	--
Aspen	59,910.7	--	972.7	934.6	--	224.8	57,778.6	--
Birch	6,038.3	--	1,067.2	--	--	--	4,971.1	--
Boxelder	5,320.7	--	--	4,395.2	252.2	275.6	397.7	--
Total	205,420.4	--	26,368.4	65,557.2	16,759.7	16,651.4	80,012.2	71.5
All species	207,114.6	1,694.2	26,368.4	65,557.2	16,759.7	16,651.4	80,012.2	71.5

Table 41.--Net volume of sawtimber on commercial forest land by species group and forest type, North Dakota, 1980

(In thousand board feet)[1/]

Species group	All types	Forest type					
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen
SOFTWOODS							
Ponderosa pine	3,152.5	3,152.5	--	--	--	--	--
Total	3,152.5	3,152.5	--	--	--	--	--
HARDWOODS							
Oak	66,082.6	--	28,396.6	27,977.9	--	8,403.8	1,304.3
Basswood	50,116.3	--	7,620.3	3,030.0	--	39,466.0	--
Elm	120,671.6	--	6,224.8	92,315.3	394.1	18,432.2	3,305.2
Ash	83,458.4	--	3,644.9	72,717.9	--	7,095.6	--
Cottonwood	105,787.6	--	--	36,387.4	69,400.2	--	--
Hackberry	621.7	--	--	621.7	--	--	--
Balsam poplar	13,510.6	--	--	3,187.3	--	--	10,323.3
Aspen	47,777.2	--	979.6	1,161.5	--	1,291.7	44,344.4
Birch	9,303.7	--	--	--	--	--	9,303.7
Boxelder	9,456.7	--	--	8,540.3	--	916.4	--
Total	506,786.4	--	46,866.2	245,939.3	69,794.3	75,605.7	68,580.9
All species	509,938.9	3,152.5	46,866.2	245,939.3	69,794.3	75,605.7	68,580.9

[1/]International 1/4-inch rule.

Table 42.--Net volume of sawtimber on commercial forest land by species group and butt log-grade class, North Dakota, 1980

(In thousand board feet)[1/]

Species group	All grades	Butt log-grade class			
		1	2	3	Tie and timber
SOFTWOODS					
Ponderosa pine	3,152.5	--	--	3,152.5	--
Total	3,152.5	--	--	3,152.5	--
HARDWOODS					
Oak	66,082.6	521.9	7,306.7	37,135.2	21,118.8
Basswood	50,116.3	11,526.2	17,390.4	20,596.4	603.3
Elm	120,671.6	11,000.9	35,911.5	64,618.9	9,140.3
Ash	83,458.4	5,140.5	21,067.5	44,489.2	12,761.2
Cottonwood	105,787.6	25,667.9	30,667.4	44,456.9	4,995.4
Hackberry	621.7	--	--	621.7	--
Balsam poplar	13,510.6	1,140.7	4,160.3	6,644.6	1,565.0
Aspen	47,777.2	--	8,590.3	38,370.1	816.8
Birch	9,303.7	--	--	7,949.1	1,354.6
Boxelder	9,456.7	457.0	1,011.1	6,152.6	1,836.0
Total	506,786.4	55,455.1	126,105.2	271,034.7	54,191.4
All species	509,938.9	55,455.1	126,105.2	274,187.2	54,191.4

[1/]International 1/4-inch rule.

Table 43.--All live tree biomass on commercial forest land by species group and biomass component, North Dakota, 1980

Species group	Biomass component							Biomass component					
			Growing stock		Cull				Growing stock		Cull		
	All components	1- to 5-inch trees	Boles	Tops and limbs	Boles	Tops and limbs	All components	1- to 5-inch trees	Boles	Tops and limbs	Boles	Tops and limbs
	Thousand green tons						Thousand cubic feet					
SOFTWOODS												
Ponderosa pine	71.4	4.4	43.6	19.8	2.5	1.1	3,699.7	431.0	2,122.4	967.5	122.9	55.9
Other softwoods	1.1	1.1	--	--	--	--	104.5	104.5	--	--	--	--
Total	72.5	5.5	43.6	19.8	2.5	1.1	3,804.2	535.5	2,122.4	967.5	122.9	55.9
HARDWOODS												
Oak	2,754.1	610.1	1,063.5	501.0	391.7	187.8	118,080.6	41,896.5	37,734.1	17,786.4	13,941.0	6,722.6
Basswood	498.1	--	268.1	127.2	57.1	45.7	23,996.9	--	12,851.1	6,092.4	2,788.8	2,264.6
Elm	2,183.0	115.2	869.2	424.5	505.7	268.4	90,229.9	8,957.0	34,091.4	16,654.5	19,908.7	10,618.3
Ash	2,706.0	589.3	897.0	429.6	498.6	291.5	140,983.2	49,941.3	38,382.1	18,385.6	21,572.1	12,702.1
Cottonwood	1,430.5	61.9	703.9	337.9	203.0	123.8	58,022.6	4,814.9	27,300.1	13,105.5	7,922.7	4,879.4
Hackberry	20.8	4.0	5.6	2.6	5.3	3.3	979.0	309.1	218.7	102.4	214.3	134.5
Balsam poplar	564.2	94.5	299.8	141.1	16.9	11.9	33,435.9	9,558.0	15,233.7	7,171.2	862.9	610.1
Aspen	3,987.5	940.0	1,535.8	714.2	470.9	326.6	235,297.8	89,313.4	73,300.5	34,089.1	22,738.3	15,856.5
Birch	350.4	47.9	170.0	80.7	33.7	18.1	16,572.6	3,983.6	7,068.0	3,356.5	1,405.4	759.1
Boxelder	1,126.7	198.9	166.6	82.0	436.2	243.0	54,423.8	15,993.3	6,849.8	3,371.5	18,046.0	10,163.2
Other hardwoods	4.2	4.2	--	--	--	--	352.6	352.6	--	--	--	--
Noncommercial species	269.5	54.1	--	--	139.3	76.1	13,667.6	4,501.0	--	--	5,907.9	3,258.7
Total	15,895.0	2,720.1	5,979.5	2,840.8	2,758.4	1,596.2	786,042.5	229,620.7	253,029.5	120,115.1	115,308.1	67,969.1
All species	15,967.5	2,725.6	6,023.1	2,860.6	2,760.9	1,597.3	789,846.7	230,156.2	255,151.9	121,082.6	115,431.0	68,025.0

Table 44.--All live tree biomass on commercial forest land by species group and forest type, North Dakota, 1980

(In thousand green tons)

Species group	All types	Forest type						
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocked
SOFTWOODS								
Ponderosa pine	71.4	71.4	--	--	--	--	--	--
Other softwoods	1.1	1.1	--	--	--	--	--	--
Total	72.5	72.5	--	--	--	--	--	--
HARDWOODS								
Oak	2,754.1	--	1,687.6	410.2	--	263.6	356.4	36.3
Basswood	498.1	--	90.9	46.9	--	360.3	--	--
Elm	2,183.0	--	113.4	1,704.2	57.5	252.8	55.1	--
Ash	2,706.0	5.8	242.3	1,904.4	67.8	66.8	363.2	55.7
Cottonwood	1,430.5	--	--	452.0	960.5	18.0	--	--
Hackberry	20.8	--	--	20.8	--	--	--	--
Balsam poplar	564.2	--	12.3	60.7	--	--	491.2	--
Aspen	3,987.5	--	67.0	116.0	--	11.9	3,787.9	4.7
Birch	350.4	--	54.7	--	3.1	--	292.6	--
Boxelder	1,126.7	--	21.1	948.3	22.7	31.0	57.6	46.0
Other hardwoods	4.2	--	--	4.2	--	--	--	--
Noncommercial species	269.5	--	4.4	207.5	7.6	2.1	47.2	0.7
Total	15,895.0	5.8	2,293.7	5,875.2	1,119.2	1,006.5	5,451.2	143.4
All species	15,967.5	78.3	2,293.7	5,875.2	1,119.2	1,006.5	5,451.2	143.4

Table 45.--All live shrub biomass on commercial forest land by shrub species group and forest type, North Dakota, 1980[1/]

(In green tons)

EAST UNIT

Shrub species group	All types	Forest type						
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocked
TALL SHRUBS								
Boxelder	9,024.0	--	231.2	6,447.6	--	2,081.2	264.0	--
Birch	1,424.4	--	--	--	--	--	1,424.4	--
Dogwood	21,146.8	--	7.2	1,251.6	--	--	19,682.0	206.0
Hawthorn	874.0	--	--	--	--	--	874.0	--
Ash	32,119.6	--	10,461.2	18,286.4	--	125.2	3,246.8	--
Ironwood	16.4	--	--	--	--	16.4	--	--
Aspen	117,548.4	--	2,669.6	53.6	--	--	114,825.2	--
Cherry	105,110.0	--	18,643.2	16,303.2	--	2,812.0	55,195.6	12,156.0
Oak	2,193.6	--	1,671.2	395.6	--	8.8	118.0	--
Hazel	265,505.6	--	21,808.4	7,354.4	--	2,249.6	233,346.8	746.4
Juneberry	155,069.6	--	44,320.8	3,946.4	--	19,943.2	80,514.0	6,345.2
Viburnum	27,664.0	--	13,509.6	2,286.0	--	--	11,868.4	--
Alder buckthorn	89.6	--	--	89.6	--	--	--	--
Sumac	7,025.6	--	7,025.6	--	--	--	--	--
Willow	22,697.2	--	1,049.6	--	--	--	21,647.6	--
Basswood	24.0	--	6.8	6.0	--	11.2	--	--
Elm	15,329.6	--	371.6	8,075.2	--	6,880.4	2.4	--
Total	782,862.4	--	121,776.0	64,495.6	--	34,128.0	543,009.2	19,453.6
LOW SHRUBS:								
Virginia creeper	66.3	--	--	66.3	--	--	--	--
Spirea	96.3	--	--	--	--	--	96.3	--
Ribes	2,396.8	--	89.7	1,008.3	--	82.3	1,129.3	87.2
Chokeberry	48.2	--	48.2	--	--	--	--	--
Rubus	657.4	--	10.5	19.5	--	--	627.4	--
Rosa	8,610.3	--	410.6	1,568.8	--	--	6,630.9	--
Honeysuckle	16,265.5	--	2,423.5	10,063.7	66.8	705.1	2,761.2	245.2
Snowberry	9,975.9	--	2,470.3	698.3	--	450.1	6,223.0	134.2
Poison ivy	3,147.0	--	1,581.6	896.8	--	201.6	385.4	81.6
Grape	1,284.2	--	189.7	923.8	--	84.7	--	86.0
Total	42,547.9	--	7,224.1	15,245.5	66.8	1,523.8	17,853.5	634.2
All shrubs	825,410.3	--	129,000.1	79,741.1	66.8	35,651.8	560,862.7	20,087.8

(Table 45 continued on next page)

[1/] Including trees less than 1 inch in diameter.

(Table 45 continued)

WEST UNIT

Shrub species group	All types	Forest type: Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocked
TALL SHRUBS								
Boxelder	12,081.2	0.8	1.2	11,952.8	1.6	--	--	124.8
Dogwood	10,429.6	--	--	6,264.8	325.6	--	3,839.2	--
Ash	12,214.8	1,201.2	22.0	7,100.4	536.8	--	2,902.4	452.0
Aspen	4,503.2	--	--	3,788.8	5.2	--	709.2	--
Cherry	19,920.0	2,602.8	406.4	3,019.6	1,706.4	--	12,184.8	--
Oak	161.2	--	161.2	--	--	--	--	--
Hazel	17,687.6	--	14,954.0	--	--	--	2,733.6	--
Juneberry	26,536.4	--	--	3,980.0	3,799.6	--	17,824.0	932.8
Willow	27,938.4	--	--	--	27,938.4	--	--	--
Elm	1,234.0	--	6.8	1,213.2	3.2	--	--	10.8
Total	132,706.4	3,804.8	15,551.6	37,319.6	34,316.8	--	40,193.2	1,520.4
LOW SHRUBS								
Juniper	643.2	643.2	--	--	--	--	--	--
Virginia creeper	242.7	--	--	63.4	179.3	--	--	--
Ribes	679.7	243.8	--	88.0	179.3	--	168.6	--
Rubus	22.4	--	21.4	--	--	--	1.0	--
Rosa	2,055.6	186.2	311.5	185.6	605.6	--	766.7	--
Honeysuckle	10,107.9	374.2	154.3	5,636.2	2,276.0	--	1,311.7	355.5
Vaccinum	36.4	--	--	36.4	--	--	--	--
Poison ivy	1,861.3	--	--	944.9	525.0	--	391.4	--
Grape	87.6	--	--	43.8	43.8	--	--	--
Total	15,736.8	1,447.4	487.2	6,998.3	3,809.0	--	2,639.4	355.5
All shrubs	148,443.2	5,252.2	16,038.8	44,317.9	38,125.8	--	42,832.6	1,875.9
State total	973,853.5	5,252.2	145,038.9	124,059.0	38,192.6	35,651.8	603,695.3	21,963.7

Table 46.--Net annual growth of growing stock on commercial forest land by species group and Forest Survey Unit, North Dakota, 1979

(In thousand cubic feet)

Species group	All units	East Unit	West Unit
SOFTWOODS			
Ponderosa pine	96.5	--	96.5
Total	96.5	--	96.5
HARDWOODS			
Oak	644.1	632.8	11.3
Basswood	307.4	307.4	--
Elm	917.5	865.5	52.0
Ash	738.1	650.4	87.7
Cottonwood	750.2	162.3	587.9
Hackberry	4.6	4.6	--
Balsam poplar	662.2	662.2	--
Aspen	2,993.6	2,858.2	135.4
Birch	360.4	343.7	16.7
Boxelder	202.6	172.1	30.5
Total	7,580.7	6,659.2	921.5
All species	7,677.2	6,659.2	1,018.0

Table 47.--Net annual growth and removals of growing stock and sawtimber on commercial forest land by species group, North Dakota, 1979

Species group	Net annual growth	Annual timber removals
	GROWING STOCK	
	- - - Thousand cubic feet- - -	
SOFTWOODS		
Ponderosa pine	96.5	7.0
Total	96.5	7.0
HARDWOODS		
Oak	644.1	286.0
Basswood	307.4	34.0
Elm	917.5	60.0
Ash	738.0	148.0
Cottonwood	750.2	207.0
Hackberry	4.6	1.0
Balsam poplar	662.2	90.0
Aspen	2993.6	567.0
Birch	360.5	53.0
Boxelder	202.6	45.0
Total	7,580.7	1,491.0
All species	7,677.2	1,498.0
	SAWTIMBER	
	- - -Thousand board feet[1]/- - -	
SOFTWOODS		
Ponderosa pine	87.9	43.0
Total	87.9	43.0
HARDWOODS		
Oak	2,149.6	502.0
Basswood	2,245.3	113.0
Elm	6,904.6	247.0
Ash	2,849.7	220.0
Cottonwood	1,821.8	974.0
Hackberry	12.8	5.0
Balsam poplar	2,158.5	92.0
Aspen	9,860.9	537.0
Birch	1,256.5	80.0
Boxelder	824.9	130.0
Total	30,084.6	2,900.0
All species	30,172.5	2,943.0

[1]/International 1/4-inch rule.

Table 48.--Net annual growth and removals of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods, North Dakota, 1979

Ownership class	Net annual growth			Annual timber removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	GROWING STOCK					
	Thousand cubic feet					
PUBLIC						
National Forest	40.5	--	40.5	--	--	--
Misc. federal	167.1	--	167.1	12.0	7.0	5.0
Indian	499.1	--	499.1	48.0	--	48.0
State	641.7	--	641.7	--	--	--
County & municipal	53.0	--	53.0	--	--	--
Total	1,401.4	--	1,401.4	60.0	7.0	53.0
PRIVATE						
Farmer	6,139.2	96.5	6,042.7	1,438.0	--	1,438.0
Misc. private	136.6	--	136.6	--	--	--
Total	6,275.8	96.5	6,179.3	1,438.0	--	1,438.0
All owners	7,677.2	96.5	7,580.7	1,498.0	7.0	1,491.0
	SAWTIMBER					
	Thousand board feet[1]					
PUBLIC						
National Forest	--	--	--	--	--	--
Misc. federal	726.3	--	726.3	57.0	43.0	14.0
Indian	319.9	--	319.9	140.0	--	140.0
State	7,488.6	--	7,488.6	--	--	--
County & municipal	385.2	--	385.2	--	--	--
Total	8,920.0	--	8,920.0	197.0	43.0	154.0
PRIVATE						
Farmer	20,639.4	87.9	20,551.5	2,746.0	--	2,746.0
Misc. private	613.1	--	613.1	--	--	--
Total	21,252.5	87.9	21,164.6	2,746.0	--	2,746.0
All owners	30,172.5	87.9	30,084.6	2,943.0	43.0	2,900.0

[1]International 1/4-inch rule.

Table 49.--Timber removals from growing stock and sawtimber on commercial forest land by item and species category, North Dakota, 1979

Item	All species	Softwoods	Elm	Ash	Aspen	Other hardwoods
			Species category			
GROWING STOCK						
	- - - - - - - - - Thousand cubic feet- - - - - - - - -					
ROUNDWOOD PRODUCTS						
Saw logs	117	7	--	--	4	106
Fuelwood	198	--	10	33	48	107
Posts	8	--	--	7	--	1
Total	323	7	10	40	52	214
LOGGING RESIDUE	20	--	--	--	--	20
OTHER REMOVALS	1,155	--	50	108	515	482
TOTAL	1,498	7	60	148	567	716
SAWTIMBER						
	- - - - - - - - - Thousand board feet[1]- - - - - - - - -					
ROUNDWOOD PRODUCTS						
Saw logs	617	43	--	--	15	559
Fuelwood	579	--	31	89	130	329
Posts	1	--	--	1	--	--
Total	1,197	43	31	90	145	888
LOGGING RESIDUE	71	--	--	--	--	71
OTHER REMOVALS	1,675	--	216	130	392	937
TOTAL	2,943	43	247	220	537	1,896

[1]/International 1/4-inch rule.

Table 50.--Annual mortality of growing stock and sawtimber on commercial forest land by species group and Forest Survey Unit, North Dakota, 1979

Species group	All Units		East Unit		West Unit	
	Growing stock	Sawtimber	Growing stock	Sawtimber	Growing stock	Sawtimber
	Thousand cubic feet	Thousand board feet[1]/	Thousand cubic feet	Thousand board feet[1]/	Thousand cubic feet	Thousand board feet[1]/
SOFTWOODS						
Ponderosa pine	0.3	--	--	--	0.3	--
Total	0.3	--	--	--	0.3	--
HARDWOODS						
Oak	54.5	88.5	53.4	88.5	1.1	--
Basswood	31.1	152.8	31.1	152.8	--	--
Elm	103.5	485.8	96.7	456.2	6.8	29.6
Ash	171.9	851.2	152.7	779.5	19.2	71.7
Cottonwood	71.3	360.4	4.7	22.3	66.6	338.1
Hackberry	0.4	1.4	0.4	1.4	--	--
Balsam poplar	209.9	204.6	209.9	204.6	--	--
Aspen	938.4	628.8	910.9	615.2	27.5	13.6
Birch	2.5	3.8	2.3	3.8	0.2	--
Boxelder	9.1	23.8	7.9	22.0	1.2	1.8
Total	1,592.6	2,801.1	1,470.0	2,346.3	122.6	454.8
All species	1,592.9	2,801.1	1,470.0	2,346.3	122.9	454.8

[1]/International 1/4-inch rule.

Table 51.--Annual mortality of growing stock and sawtimber on commercial forest land by species group and cause, North Dakota, 1979

Species group	All causes	Cause				
		Disease	Fire	Animals	Weather	Unknown and other
GROWING STOCK						
	- - - - - - - - - - Thousand cubic feet - - - - - - - - - -					
SOFTWOODS						
Ponderosa pine	0.3	--	--	--	--	0.3
Total	0.3	--	--	--	--	0.3
HARDWOODS						
Oak	54.5	--	--	--	--	54.5
Basswood	31.1	--	--	--	--	31.1
Elm	103.5	--	--	59.5	--	44.0
Ash	171.9	35.4	--	59.7	47.7	29.1
Cottonwood	71.3	--	--	--	--	71.3
Hackberry	0.4	--	--	--	--	0.4
Balsam poplar	209.9	--	--	--	209.9	--
Aspen	938.4	652.7	--	--	158.7	127.0
Birch	2.5	--	--	--	--	2.5
Boxelder	9.1	9.1	--	--	--	--
Total	1,592.6	697.2	--	119.2	416.3	359.9
All species	1,592.9	697.2	--	119.2	416.3	360.2
SAWTIMBER						
	- - - - - - - - - Thousand board feet[1/] - - - - - - - - -					
SOFTWOODS						
Ponderosa pine	--	--	--	--	--	--
Total	--	--	--	--	--	--
HARDWOODS						
Oak	88.5	--	--	--	--	88.5
Basswood	152.8	--	--	--	--	152.8
Elm	485.8	--	--	485.8	--	--
Ash	851.2	320.0	--	282.8	--	248.4
Cottonwood	360.4	--	--	--	--	360.4
Hackberry	1.4	--	--	--	--	1.4
Balsam poplar	204.6	--	--	--	204.6	--
Aspen	628.8	499.7	--	--	129.1	--
Birch	3.8	--	--	--	--	3.8
Boxelder	23.8	23.8	--	--	--	--
Total	2,801.1	843.5	--	768.6	333.7	855.3
All species	2,801.1	843.5	--	768.6	333.7	855.3

[1/] International 1/4-inch rule.

Table 52.--Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods, North Dakota, 1979

Ownership class	All species	Softwoods	Hardwoods
	GROWING STOCK		
	- - - - Thousand cubic feet- - - -		
National Forest	2.9	--	2.9
Miscellaneous federal	37.4	--	37.4
Indian	141.1	--	141.1
State	207.2	--	207.2
County & municipal	1.2	--	1.2
Forest industry	--	--	--
Farmer	1,171.3	0.3	1,169.9
Misc. priv.-indiv.	31.8	--	31.8
All owners	1,592.9	0.3	1,592.6
	SAWTIMBER		
	- - - - Thousand board feet[1]- - - -		
National Forest	--	--	--
Miscellaneous federal	48.3	--	48.3
Indian	61.9	--	61.9
State	188.8	--	188.8
County & municipal	2.6	--	2.6
Forest industry	--	--	--
Farmer	2,466.1	--	2,466.1
Misc. priv.-indiv.	33.4	--	33.4
All owners	2,801.1	--	2,801.1

[1] International 1/4-inch rule.

Table 53.--Output of timber products by product, softwoods and hardwoods, and source of material, North Dakota, 1977

Product and softwoods and hardwoods	Standard units	Total		Roundwood products				Plant byproducts	
				Growing stock		Nongrowing stock			
		No. of units	Thousand cubic feet	No. of units	Thousand cubic feet	No. of units	Thousand cubic feet	No. of units	Thousand cubic feet
SAW LOGS									
Softwood	[1]/Thousand	44	7	44	7	--	--	--	--
Hardwood	board feet	646	112	634	110	12	2	--	--
Total		690	119	678	117	12	2	--	--
FUELWOOD									
Softwood	[2]/Standard	31	2	1	[3]/	2	[3]/	28	2
Hardwood	cords	7,047	442	3,170	198	3,634	227	243	17
Total		7,078	444	3,171	198	3,636	227	271	19
POSTS									
Softwood	Thousand	--	--	--	--	--	--	--	--
Hardwood	pieces	38	16	19	8	19	8	--	--
Total		38	16	19	8	19	8	--	--
ALL PRODUCTS									
Softwood	Thousand	75	9	45	7	2	--	28	2
Hardwood	cubic feet	7,731	570	3,823	316	3,665	237	243	17
Total		7,806	579	3,868	323	3,667	237	271	19

[1]/International 1/4-inch rule.
[2]/Rough-wood, 128 cubic-foot basis.
[3]/Less than 500 cubic feet.

Table 54.--Output of roundwood products by product, softwoods and hardwoods, and source of material, North Dakota, 1977

(In thousand cubic feet)

Product and softwoods and hardwoods	All sources	Growing-stock trees			Rough and rotten trees	Salvable dead trees	Other sources
		Total	Sawtimber	Poletimber			
INDUSTRIAL PRODUCTS							
Saw logs							
Softwood	7	7	7	--	--	--	--
Hardwood	112	110	102	8	--	--	2
Subtotal	119	117	109	8	--	--	2
Posts (Round and split)							
Softwood	--	--	--	--	--	--	--
Hardwood	16	8	--	8	--	--	8
Subtotal	16	8	--	8	--	--	8
All industrial products							
Softwood	7	7	7	--	--	--	--
Hardwood	128	118	102	16	--	--	10
Total	135	125	109	16	--	--	10
FUELWOOD							
Softwood	--	--	--	--	--	--	--
Hardwood	425	198	106	92	95	2	130
Total	425	198	106	92	95	2	130
ALL PRODUCTS							
Softwood	7	7	7	--	--	--	--
Hardwood	553	316	208	108	95	2	140
Total	560	323	215	108	95	2	140

Table 55.--Volume of primary plant residue by type of use and kind of material, North Dakota, 1977

(In thousand cubic feet)

Type of use	Kind of wood residue							
	Total		Coarse[1/]		Fine[2/]		Bark	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Industrial fuel	--	3.1	--	3.1	--	--	--	--
Domestic fuel	1.7	13.8	1.7	12.4	--	1.4	1.1	8.0
Miscellaneous[3/]	--	12.0	--	0.5	--	11.5	--	--
Not used[4/]	1.6	20.3	0.4	15.0	1.2	5.3	0.3	12.1
Total	3.3	49.2	2.1	31.0	1.2	18.2	1.4	20.1

1/Suitable for chipping such as slabs, edgings, veneer cores, etc.
2/Not suitable for chipping such as sawdust, veneer clippings, etc.
3/Livestock bedding, mulch, small dimension, and specialty items.
4/Includes residue burned as waste.

Table 56.--Removals[1], net annual growth, and inventory of growing stock on 1980, and low removals option projections[2] to 2010

(In million cubic feet)

Year	All species		
	Removals	Growth	Inventory
1980	1.5	8.8	207.0
1990	2.1	11.6	293.8
2000	2.9	12.1	387.5
2010	4.4	12.6	476.2

[1] The volume of timber removals includes volume "lost" due to land clearing, flooding, thinning, or changes in land use, in addition to timber cut and used.

[2] Based on the following assumptions: (a) the overall removals rate will be lower than that for the high removals option; (b) the annual removals rates will differ for each product, but the average annual removals rate will be 0.9 percent; (c) the total area of commercial forest land will continue to decline; (d) radial growth will decline over time in relation to the increase of basal area per acre of trees; (e) the intensity of forest management will continue at the rate indicated by recent trends; (f) the volume of "other" removals will drop during the period as more of these trees are utilized and the decline in commercial forest area stabilizes.

Table 57.--Removals[1], net annual growth, and inventory of growing stock on commercial forest land, North Dakota, 1980, and high removals option projections[2] to 2010

(In million cubic feet)

Year	All species		
	Removals	Growth	Inventory
1980	1.6	8.7	207.0
1990	2.4	11.5	292.7
2000	4.2	11.9	378.9
2010	10.0	12.0	435.6

[1] The volume of timber removals includes volume "lost" due to land clearing, flooding, thinning, or changes in land use, in addition to timber cut and used.

[2] Based on the following assumptions: (a) the overall removals rate will be higher than that for the low removals option; (b) the annual removals rates will differ for each product, but the average annual removals rate will be 1.8 percent; (c) the total area of commercial forest land will continue to decline; (d) radial growth will decline over time in relation to the increase of basal area per acre of trees; (e) the intensity of forest management will continue at the rate indicated by recent trends; (f) the volume of "other" removals will drop during the period as more of these trees are utilized and the decline in commercial forest area stabilizes.

Table 58.--Timber volume targeted for removal on commercial forest land qualifying for treatment by species group, tree class, and treatment, North Dakota, 1980-1990

(In thousand cubic feet)

Species group[1/]	All classes	Tree class: Growing stock: Poletimber	Tree class: Growing stock: Sawtimber	Tree class: Cull: Short-log	Tree class: Cull: Other	Salvable dead
HARVEST						
HARDWOODS						
Oak	12,146.8	3,643.0	6,202.4	622.8	1,372.1	306.5
Basswood	4,446.2	213.4	3,582.3	127.1	523.4	--
Elm	20,084.6	1,826.0	15,329.5	1,169.0	1,439.9	320.2
Ash	18,262.3	4,464.0	7,440.9	996.2	4,855.0	506.2
Eastern cottonwood	6,923.4	--	5,588.5	657.1	658.3	19.5
Hackberry	230.8	85.4	99.7	39.1	6.6	--
Balsam poplar	9,742.0	6,212.5	3,380.8	--	100.5	48.2
Aspen	59,686.5	34,753.2	16,332.1	212.8	7,310.6	1,077.8
Birch	5,986.6	2,743.3	2,703.7	232.1	245.6	61.9
Boxelder	3,875.1	1,224.3	1,080.5	122.2	1,351.9	96.2
Other hardwoods[2/]	--	--	--	--	--	--
Noncommercial species	1,288.4	--	--	--	386.3	902.1
Total	142,672.7	55,165.1	61,740.4	4,178.4	18,250.2	3,338.6
THIN						
HARDWOODS						
Oak	86.8	--	--	--	86.8	--
Basswood	--	--	--	--	--	--
Elm	765.8	304.8	328.0	122.9	10.1	--
Ash	635.5	256.8	--	99.1	279.6	--
Eastern cottonwood	2,360.7	2,086.1	--	--	274.6	--
Hackberry	--	--	--	--	--	--
Balsam poplar	--	--	--	--	--	--
Aspen	57.6	--	--	--	57.6	--
Birch	--	--	--	--	--	--
Boxelder	216.4	--	--	--	216.4	--
Other hardwoods[2/]	--	--	--	--	--	--
Noncommercial species	9.3	--	--	--	9.3	--
Total	4,132.1	2,647.7	328.0	222.0	934.4	--
STAND CONVERSION OR RESTOCKING						
HARDWOODS						
Oak	880.7	191.0	529.6	--	160.1	--
Basswood	--	--	--	--	--	--
Elm	3,269.5	--	2,879.5	208.8	139.6	41.6
Ash	1,900.0	520.6	654.7	--	558.6	166.1
Eastern cottonwood	--	--	--	--	--	--
Hackberry	--	--	--	--	--	--
Balsam poplar	1,030.1	1,030.1	--	--	--	--
Aspen	516.3	273.1	--	--	243.2	--
Birch	--	--	--	--	--	--
Boxelder	446.3	154.0	61.1	96.4	129.7	5.1
Other hardwoods[2/]	7,081.4	--	5,618.6	1,310.3	152.5	--
Noncommercial species	--	--	--	--	--	--
Total	15,124.3	2,168.8	9,743.5	1,615.5	1,383.7	212.8

[1/]No softwood volume was targeted for removal.

[2/]Predominately plains cottonwood.

Table 59.--Growing-stock volume targeted for removal on commercial forest land qualifying for treatment by species group, forest type, and treatment, North Dakota, 1980-1990

(In thousand cubic feet)

Species group[1]	All types	Forest type				
		Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen
HARVEST						
HARDWOODS						
Oak	9,845.4	2,087.6	3,354.7	--	1,766.5	2,636.6
Basswood	4,611.7	--	527.8	--	3,267.9	816.0
Elm	18,690.5	704.5	13,391.9	186.4	2,056.7	2,351.0
Ash	9,554.0	321.5	8,880.1	49.1	303.3	--
Eastern cottonwood	5,588.5	--	1,896.4	3,692.1	--	--
Hackberry	185.1	--	185.1	--	--	--
Balsam poplar	9,593.3	--	394.0	--	--	9,199.3
Aspen	51,085.2	--	970.3	--	--	50,114.9
Birch	5,446.9	--	--	--	--	5,446.9
Boxelder	2,304.8	--	1,601.4	187.2	194.3	321.9
Other hardwoods[2]	--	--	--	--	--	--
Noncommercial species	--	--	--	--	--	--
Total	116,905.4	3,113.6	31,201.7	4,114.8	7,588.7	70,886.6
THIN						
HARDWOODS						
Oak	--	--	--	--	--	--
Basswood	--	--	--	--	--	--
Elm	632.9	--	632.9	--	--	--
Ash	256.8	--	256.8	--	--	--
Eastern cottonwood	2,086.1	--	--	2,086.1	--	--
Hackberry	--	--	--	--	--	--
Balsam poplar	--	--	--	--	--	--
Aspen	--	--	--	--	--	--
Birch	--	--	--	--	--	--
Boxelder	--	--	--	--	--	--
Other hardwoods[2]	--	--	--	--	--	--
Noncommercial species	--	--	--	--	--	--
Total	2,975.8	--	889.7	2,086.1	--	--
STAND CONVERSION OR RESTOCKING						
HARDWOODS						
Oak	720.6	--	720.6	--	--	--
Basswood	--	--	--	--	--	--
Elm	2,879.5	--	2,879.5	--	--	--
Ash	1,175.3	--	1,175.3	--	--	--
Eastern cottonwood	--	--	--	--	--	--
Hackberry	--	--	--	--	--	--
Balsam poplar	1,030.1	--	--	--	--	1,030.1
Aspen	273.1	--	--	--	--	273.1
Birch	--	--	--	--	--	--
Boxelder	215.1	--	119.9	--	--	95.2
Other hardwoods[2]	5,618.6	--	--	5,618.6	--	--
Noncommercial species	--	--	--	--	--	--
Total	11,912.3	--	4,895.3	5,618.6	--	1,398.4

[1]/No softwood was targeted for removal.

[2]/Predominately plains cottonwood.

Table 60.--Area of commercial forest land qualifying for treatment by forest type, stand-age class, and treatment class, North Dakota, 1980-1990

(In thousand acres)

Forest type[1/]	All classes	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
HARVEST														
Ponderosa pine	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oak	1.7	--	--	--	--	--	--	--	--	--	1.7	--	--	--
Elm-ash	49.4	--	--	--	--	--	--	--	11.3	11.3	6.9	15.3	4.6	--
Cottonwood	5.1	--	--	--	--	--	--	--	--	3.3	--	1.8	--	--
Plains hardwoods	7.3	--	--	--	--	--	--	--	--	--	5.0	2.3	--	--
Aspen	71.9	--	--	--	--	47.1	14.6	5.0	5.2	--	--	--	--	--
All types	135.4	--	--	--	--	47.1	14.6	5.0	16.5	14.6	13.6	19.4	4.6	--
THIN														
Ponderosa pine	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oak	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Elm-ash	9.9	2.3	1.7	--	2.5	3.4	--	--	--	--	--	--	--	--
Cottonwood	3.0	--	--	--	3.0	--	--	--	--	--	--	--	--	--
Plains hardwoods	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aspen	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All types	12.9	2.3	1.7	--	5.5	3.4	--	--	--	--	--	--	--	--
STAND CONVERSION OR RESTOCKING														
Ponderosa pine	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oak	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Elm-ash	17.2	3.4	2.5	--	--	--	1.7	--	--	1.7	1.7	4.6	1.6	--
Cottonwood	3.4	--	--	--	--	--	--	--	--	--	--	3.4	--	--
Plains hardwoods	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aspen	7.1	7.1	--	--	--	--	--	--	--	--	--	--	--	--
All types	27.7	10.5	2.5	--	--	--	1.7	--	--	1.7	1.7	8.0	1.6	--
NO TREATMENT														
Ponderosa pine	2.1	--	--	--	--	--	--	2.1	--	--	--	--	--	--
Oak	42.5	2.3	2.3	--	3.4	7.8	16.2	3.4	4.5	2.6	--	--	--	--
Elm-ash	46.4	19.4	9.7	--	--	1.9	4.9	10.5	--	--	--	--	--	--
Cottonwood	7.2	2.5	2.4	--	--	2.3	--	--	--	--	--	--	--	--
Plains hardwoods	8.5	--	--	--	--	--	--	2.3	1.6	4.6	--	--	--	--
Aspen	60.5	21.7	12.5	6.1	20.2	--	--	--	--	--	--	--	--	--
All types	167.2	45.9	26.9	6.1	23.6	12.0	21.1	18.3	6.1	7.2	--	--	--	--

[1/] The 9,200 acres of nonstocked commercial forest land is included in the cottonwood forest type.

Table 61.--Growing-stock volume targeted for removal on commercial forest land qualifying for treatment by forest type, stand-age class, and treatment class, North Dakota, 1980-1990

(In thousand cubic feet)

Forest type[1/]	All classes	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
HARVEST														
Oak	3,113.6	--	--	--	--	--	--	--	--	--	3,113.6	--	--	--
Elm-ash	31,201.6	--	--	--	--	--	--	--	5,076.6	9,198.4	3,774.7	10,920.7	2,231.2	--
Cottonwood	4,114.7	--	--	--	--	--	--	--	--	2,823.9	--	1,290.8	--	--
Plains hardwoods	7,588.7	--	--	--	--	--	--	--	--	--	6,578.9	1,009.8	--	--
Aspen	70,886.7	--	--	--	--	46,878.8	14,279.1	4,603.2	5,125.6	--	--	--	--	--
All types	116,905.4	--	--	--	--	46,878.8	14,279.1	4,603.2	10,202.2	12,022.4	13,467.2	13,221.3	2,231.2	--
THIN														
Oak	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Elm-ash	889.6	--	--	--	889.6	--	--	--	--	--	--	--	--	--
Cottonwood	2,086.1	--	--	--	2,086.1	--	--	--	--	--	--	--	--	--
Plains hardwoods	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aspen	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All types	2,975.7	--	--	--	2,975.7	--	--	--	--	--	--	--	--	--
STAND CONVERSION OR RESTOCKING														
Oak	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Elm-ash	4,895.4	--	103.5	--	--	--	219.3	--	--	368.7	739.6	2,278.5	1,185.8	--
Cottonwood	5,618.6	--	--	--	--	--	--	--	--	--	--	5,618.6	--	--
Plains hardwoods	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aspen	1,398.4	1,398.4	--	--	--	--	--	--	--	--	--	--	--	--
All types	11,912.4	1,398.4	103.5	--	--	--	219.3	--	--	368.7	739.6	7,897.1	1,185.8	--

1/Volume on the 9,200 acres of nonstocked commercial forest land is included in the cottonwood forest type.

Table 62.--Area of commercial forest land qualifying for treatment by forest type, site-index class, and treatment class, North Dakota, 1980-1990

(In thousand acres)

Forest type[1/]	All classes	Site-index class (feet)								
		11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91+
HARVEST										
Ponderosa pine	--	--	--	--	--	--	--	--	--	--
Oak	1.7	--	--	--	--	1.7	--	--	--	--
Elm-ash	49.4	--	--	11.9	19.3	16.4	1.8	--	--	--
Cottonwood	5.1	--	--	1.7	1.7	--	1.7	--	--	--
Plains hardwoods	7.3	--	--	5.6	--	--	1.7	--	--	--
Aspen	71.9	--	--	1.7	2.5	32.1	30.4	5.2	--	--
All types	135.4	--	--	20.9	23.5	50.2	35.6	5.2	--	--
THIN										
Ponderosa pine	--	--	--	--	--	--	--	--	--	--
Oak	--	--	--	--	--	--	--	--	--	--
Elm-ash	9.9	--	--	1.7	4.2	--	4.0	--	--	--
Cottonwood	3.0	--	--	--	--	--	--	--	3.0	--
Plains hardwoods	--	--	--	--	--	--	--	--	--	--
Aspen	--	--	--	--	--	--	--	--	--	--
All types	12.9	--	--	1.7	4.2	--	4.0	--	3.0	--
STAND CONVERSION OR RESTOCKING										
Ponderosa pine	--	--	--	--	--	--	--	--	--	--
Oak	--	--	--	--	--	--	--	--	--	--
Elm-ash	17.2	--	--	11.6	3.3	2.3	--	--	--	--
Cottonwood	3.4	--	--	--	--	--	--	--	--	3.4
Plains hardwoods	--	--	--	--	--	--	--	--	--	--
Aspen	7.1	--	--	--	4.6	--	2.5	--	--	--
All types	27.7	--	--	11.6	7.9	2.3	2.5	--	--	3.4
NO TREATMENT										
Ponderosa pine	2.1	--	--	2.1	--	--	--	--	--	--
Oak	42.5	--	7.6	2.8	17.5	12.3	2.3	--	--	--
Elm-ash	46.4	--	--	10.8	11.9	5.7	12.3	4.0	1.7	--
Cottonwood	7.2	--	--	2.5	2.4	--	--	2.3	--	--
Plains hardwoods	8.5	--	--	--	4.5	2.3	1.7	--	--	--
Aspen	60.5	--	--	14.0	8.8	12.7	19.1	5.9	--	--
All types	167.2	--	7.6	32.2	45.1	33.0	35.4	12.2	1.7	--

[1/] The 9,200 acres of nonstocked commercial forest land is included in the cottonwood forest type.

Table 63.--Growing-stock volume targeted for removal on commercial forest land qualifying for treatment by forest type, site-index class, and treatment class, North Dakota, 1980-1990

(In thousand cubic feet)

Forest type[1/]	All classes	Site-index class (feet)								
		11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	90+
HARVEST										
Oak	3,113.6	--	--	--	--	3,113.6	--	--	--	--
Elm-ash	31,201.8	--	--	5,658.0	10,010.2	12,383.4	3,150.2	--	--	--
Cottonwood	4,114.7	--	--	1,492.9	1,331.0	--	1,290.8	--	--	--
Plains hardwoods	7,588.7	--	--	3,986.0	--	--	3,602.7	--	--	--
Aspen	70,886.8	--	--	481.9	2,415.2	29,506.2	31,095.3	7,388.2	--	--
All types	116,905.6	--	--	11,618.8	13,756.4	45,003.2	39,139.0	7,388.2	--	--
THIN										
Oak	--	--	--	--	--	--	--	--	--	--
Elm-ash	889.6	--	--	--	889.6	--	--	--	--	--
Cottonwood	2,086.1	--	--	--	--	--	--	--	2,086.1	--
Plains hardwoods	--	--	--	--	--	--	--	--	--	--
Aspen	--	--	--	--	--	--	--	--	--	--
All types	2,975.7	--	--	--	889.6	--	--	--	2,086.1	--
STAND CONVERSION OR RESTOCKING										
Oak	--	--	--	--	--	--	--	--	--	--
Elm-ash	4,895.4	--	--	1,721.3	1,554.5	1,619.6	--	--	--	--
Cottonwood	5,618.6	--	--	--	--	--	--	--	--	5,618.6
Plains hardwoods	--	--	--	--	--	--	--	--	--	--
Aspen	1,398.6	--	--	--	368.3	--	1,030.3	--	--	--
All types	11,912.6	--	--	1,721.3	1,922.8	1,619.6	1,030.3	--	--	5,618.6

[1/] Volume on the 9,200 acres of nonstocked commercial forest land is included in the cottonwood forest type.

Table 64.--Empirical yields from average sites by forest type and stand-age class, North Dakota, 1980

(In cubic feet per acre)

Forest type	Average all ages	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Ponderosa pine	806.8	--	--	--	--	--	--	806.8	--	--	--	--	--	--
Oak	596.6	158.6	317.8	--	304.9	346.9	565.9	1,598.3	495.8	465.3	2,051.1	--	--	--
Elm-ash	576.6	299.8	50.6	--	1,268.0	524.3	291.9	894.3	525.2	922.2	663.6	764.0	704.6	--
Cottonwood	896.2	30.9	108.3	--	1,232.9	837.4	--	--	--	994.6	--	1,445.3	--	--
Plains hardwoods	1,053.9	--	--	--	--	--	--	255.8	2,053.9	817.8	1,524.9	604.5	--	--
Aspen	573.6	137.5	151.8	235.0	625.5	779.2	942.6	1,025.8	865.3	--	--	--	--	--
Nonstocked	7.8	--	--	--	--	42.1	--	--	--	--	--	--	--	--
Average all types	603.5	164.9	115.5	235.0	705.8	692.6	664.6	954.3	705.8	861.4	1,099.2	879.9	704.6	--

Table 65.--Sampling errors[1/] for estimates other than State totals of volume, net growth, and removals and of area of commercial forest land in North Dakota, 1980

Sampling error	Commercial forest area	Growing stock			Sawtimber		
		Inventory	Growth	Removals	Inventory	Growth	Removals
Percent	Thousand acres	Million cubic feet			[2/]Million board feet		
1	15,104.4	13,831.8	738.0	1110.7	70,255.0	7,345.7	1898.7
2	3,776.1	3,458.0	184.5	277.7	17,563.8	1,836.4	474.7
3	1,678.3	1,536.9	82.0	123.4	7,806.1	816.2	211.0
4	944.0	864.5	46.1	69.4	4,390.9	459.1	118.7
5	604.2	553.3	29.5	44.4	2,810.2	293.8	75.9
10	151.0	138.3	7.4	11.1	702.6	73.5	19.0
15	67.1	61.5	3.3	4.9	312.2	32.6	8.4
20	37.8	34.6	1.8	2.8	175.6	18.4	4.7
25	24.2	22.1	1.2	1.8	112.4	11.8	3.0
50	6.0	5.5	0.3	0.4	28.1	2.9	0.8
100	1.5	1.4	0.1	0.1	7.0	0.7	0.2

[1/]At the 68-percent probability level.
[2/]International 1/4-inch rule.

Table 66.--Area by land class and Forest Survey Unit, North Dakota, 1980

(In thousand hectares)

Land class	All units	East Unit	West Unit
FOREST LAND			
Commercial	139.0	114.9	24.1
Noncommercial	89.5	19.9	69.6
Total	228.5	134.8	93.7
NONFOREST LAND			
Nonforest with trees	367.6	124.2	243.4
Nonforest without trees	17,345.2	8,734.4	8,610.8
Total	17,712.8	8,858.6	8,854.2
TOTAL LAND AREA[1/]	17,941.3	8,993.4	8,947.9

[1/]U.S. Department of Commerce, Bureau of the Census. 1970. Area Measurement reports, GE 20, No. 1, 22 p.

Table 67.--Area of commercial forest land by forest type and stand-age class, North Dakota, 1980

(In thousand hectares)

Forest type	All classes	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Ponderosa pine	0.9	--	--	--	--	--	--	0.9	--	--	--	--	--	--
Oak	17.9	0.9	0.9	--	1.4	3.2	6.6	1.3	1.8	1.1	0.7	--	--	--
Elm-ash	46.0	7.1	5.7	--	1.0	1.5	2.6	4.3	4.6	5.1	3.5	8.1	2.5	--
Cottonwood	7.6	1.0	1.0	--	1.2	0.9	--	--	--	1.4	--	2.1	--	--
Maple-basswood	6.4	--	--	--	--	--	--	0.9	0.7	1.9	2.0	0.9	--	--
Aspen-birch	56.5	11.8	5.0	2.5	8.2	19.0	5.9	2.0	2.1	--	--	--	--	--
Nonstocked	3.7	3.0	--	--	--	0.7	--	--	--	--	--	--	--	--
All types	139.0	23.8	12.6	2.5	11.8	25.3	15.1	9.4	9.2	9.5	6.2	11.1	2.5	--

Table 68.--Net volume of growing stock on commercial forest land by forest type and stand-age class, North Dakota, 1980

(In thousand cubic meters)

Forest type	All classes	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Ponderosa pine	47.9	--	--	--	--	--	--	47.9	--	--	--	--	--	--
Oak	746.2	10.3	20.7	--	29.3	76.6	259.5	153.8	63.1	34.2	98.7	--	--	--
Elm-ash	1,855.3	149.3	19.9	--	89.7	53.4	54.5	265.8	168.0	339.3	161.5	430.3	123.6	--
Cottonwood	474.3	2.2	7.4	--	104.7	54.5	--	--	--	92.9	--	212.6	--	--
Maple-basswood	471.2	--	--	--	--	--	--	16.6	93.0	106.5	215.8	39.3	--	--
Aspen-birch	2,264.3	112.0	53.7	40.6	357.6	1,038.6	389.4	145.1	127.3	--	--	--	--	--
Nonstocked	2.0	--	--	--	--	2.0	--	--	--	--	--	--	--	--
All types	5,861.2	273.8	101.7	40.6	581.3	1,225.1	703.4	629.2	451.4	572.9	476.0	682.2	123.6	--

Table 69.--Net volume of growing stock on commercial forest land by species group and forest type, North Dakota, 1980

(In thousand cubic meters)

Species group	All types	Forest type						
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Maple-basswood	Aspen-birch	Non-stocked
SOFTWOODS								
Ponderosa pine	47.9	47.9	--	--	--	--	--	--
Total	47.9	47.9	--	--	--	--	--	--
HARDWOODS								
Oak	827.2	--	489.2	154.8	--	107.5	75.7	--
Basswood	286.4	--	65.7	19.8	--	200.9	--	--
Elm	794.1	--	37.8	612.8	5.6	114.3	23.6	--
Ash	881.8	--	91.2	662.0	2.2	34.3	90.1	2.0
Cottonwood	662.2	--	--	202.8	459.4	--	--	--
Hackberry	5.1	--	--	5.1	--	--	--	--
Balsam poplar	339.8	--	4.7	47.3	--	--	287.8	--
Aspen	1,695.5	--	27.5	26.4	--	6.4	1,635.2	--
Birch	170.9	--	30.2	--	--	--	140.7	--
Boxelder	150.6	--	--	124.4	7.1	7.8	11.3	--
Total	5,813.6	--	746.3	1,855.4	474.3	471.2	2,264.4	2.0
All species	5,861.5	47.9	746.3	1,855.4	474.3	471.2	2,264.4	2.0

Table 70.--All live biomass by species and component,
North Dakota, 1980

Species group	Biomass component											
	All components	1- to 5-inch trees	Growing stock		Cull		All components	1- to 5-inch trees	Growing stock		Cull	
			Boles	Tops and limbs	Boles	Tops and limbs			Boles	Tops and limbs	Boles	Tops and limbs
	Thousand green metric tons						Thousand cubic meters					
SOFTWOODS												
Ponderosa pine	78.5	4.8	47.9	21.8	2.8	1.2	104.7	12.2	60.0	27.4	3.5	1.6
Other softwoods	1.2	1.2	--	--	--	--	3.0	3.0	--	--	--	--
Total	79.7	6.0	47.9	21.8	2.8	1.2	107.7	15.2	60.0	27.4	3.5	1.6
HARDWOODS												
Oak	3,029.5	671.1	1,169.9	551.1	430.9	206.5	3,341.7	1,185.7	1,067.9	503.4	394.5	190.2
Basswood	547.9	--	294.9	139.9	62.8	50.3	679.1	--	363.7	172.4	78.9	64.1
Elm	2,401.3	126.7	956.1	467.0	556.3	295.2	2,553.5	253.5	964.8	471.3	563.4	300.5
Ash	2,976.6	648.2	986.7	472.6	548.4	320.7	3,989.8	1,413.3	1,086.2	520.3	610.5	359.5
Cottonwood	1,573.6	68.1	774.3	371.7	223.3	136.2	1,642.0	136.3	772.5	370.9	224.2	138.1
Hackberry	22.9	4.4	6.2	2.9	5.8	3.6	27.7	8.7	6.2	2.9	6.1	3.8
Balsam poplar	620.6	104.0	329.8	155.2	18.5	13.1	946.2	270.5	431.1	202.9	24.4	17.3
Aspen	4,386.3	1,034.0	1,689.4	785.6	518.0	359.3	6,659.0	2,527.6	2,074.4	964.8	643.5	448.7
Birch	385.4	52.7	187.0	88.7	37.1	19.9	469.0	112.7	200.0	95.0	39.8	21.5
Boxelder	1,239.4	218.8	183.3	90.2	479.8	267.3	1,540.2	452.6	193.9	95.4	510.7	287.6
Other hardwoods	4.6	4.6	--	--	--	--	10.0	10.0	--	--	--	--
Noncommercial species	296.5	59.5	--	--	153.3	83.7	386.8	127.4	--	--	167.2	92.2
Total	17,484.6	2,992.1	6,577.6	3,124.9	3,034.2	1,755.8	22,245.0	6,498.3	7,160.7	3,399.3	3,263.2	1,923.5
All species	17,564.3	2,998.1	6,625.5	3,146.7	3,037.0	1,757.0	22,352.7	6,513.5	7,220.7	3,426.7	3,266.7	1,925.1

Table 71.--All live biomass on commercial forest land by shrub species group and forest type, North Dakota, 1980

(In green metric tons)

EAST UNIT

Shrub species group	All types	Forest type						
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocked
TALL SHRUBS								
Boxelder	8,203.6	--	210.4	5,861.2	--	1,892.0	240.0	--
Birch	1,294.8	--	--	--	--	--	1,294.8	--
Dogwood	19,224.4	--	6.8	1,137.6	--	--	17,892.8	187.2
Hawthorn	794.4	--	--	--	--	--	794.4	--
Ash	29,199.6	--	9,510.4	16,624.0	--	113.6	2,951.6	--
Ironwood	14.8	--	--	--	--	14.8	--	--
Aspen	106,862.0	--	2,426.8	48.8	--	--	104,386.4	--
Cherry	95,554.4	--	16,948.4	14,821.2	--	2,556.4	50,177.6	11,050.8
Oak	1,994.0	--	1,519.2	359.6	--	8.0	107.2	--
Juneberry	241,368.8	--	19,826.0	6,685.6	--	2,045.2	212,133.6	678.4
Viburnum	140,972.0	--	40,291.6	3,587.6	--	18,130.0	73,194.4	5,768.4
Hazel	25,149.2	--	12,281.6	2,078.0	--	--	10,789.6	--
Alder buckthorn	81.6	--	--	81.6	--	--	--	--
Sumac	6,386.8	--	6,386.8	--	--	--	--	--
Willow	20,634.0	--	954.4	--	--	--	19,679.6	--
Basswood	22.4	--	6.4	5.6	--	10.4	--	--
Elm	13,936.4	--	338.0	7,341.2	--	6,254.8	2.4	--
Total	711,693.2	--	110,706.8	58,632.0	--	31,025.2	493,644.4	17,684.8
LOW SHRUBS								
Virginia creeper	60.3	--	--	60.3	--	--	--	--
Spirea	87.5	--	--	--	--	--	87.5	--
Ribes	2,178.9	--	81.6	916.6	--	74.8	1,026.6	79.3
Chokeberry	43.9	--	43.9	--	--	--	--	--
Rubus	597.6	--	9.5	17.7	--	--	570.4	--
Rosa	7,827.5	--	373.2	1,426.2	--	--	6,028.1	--
Honeysuckle	14,786.8	--	2,203.2	9,148.8	60.7	641.0	2,510.2	222.9
Snowberry	9,069.1	--	2,245.8	634.8	--	409.2	5,657.3	122.0
Poison Ivy	2,860.8	--	1,437.8	815.3	--	183.2	350.3	74.2
Grape	1,167.3	--	172.4	839.8	--	77.0	--	78.1
Total	38,679.7	--	6,567.4	13,859.5	60.7	1,385.2	16,230.4	576.5
All shrubs	750,372.9	--	117,274.2	72,491.5	60.7	32,410.4	509,874.8	18,261.3

(Table 71 continued on next page)

(Table 71 continued)

WEST UNIT

Shrub Species group	All types	Forest type: Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocked
TALL SHRUBS								
Boxelder	10,983.2	0.8	1.2	10,866.4	1.6	--	--	113.2
Dogwood	9,481.2	--	--	5,695.2	296.0	--	3,490.0	--
Ash	11,104.0	1,092.0	20.0	6,454.8	488.0	--	2,638.4	410.8
Aspen	4,094.0	--	--	3,444.4	4.8	--	644.8	--
Cherry	18,109.2	2,366.4	369.6	2,745.2	1,551.2	--	11,076.8	--
Oak	146.4	--	146.4	--	--	--	--	--
Hazel	16,079.6	--	13,594.4	--	--	--	2,485.2	--
Juneberry	24,123.6	--	--	3,618.0	3,454.0	--	16,203.6	848.0
Willow	25,398.4	--	--	--	25,398.4	--	--	--
Elm	1,122.4	--	6.4	1,103.2	2.8	--	--	10.0
Total	120,642.0	3,459.2	14,138.0	33,927.2	31,196.8	--	36,538.8	1,382.0
LOW SHRUBS								
Juniper	584.7	584.7	--	--	--	--	--	--
Virginia creeper	220.7	--	--	57.7	163.0	--	--	--
Ribes	617.9	221.6	--	80.0	163.0	--	153.3	--
Rubus	20.3	--	19.4	--	--	--	0.9	--
Rosa	1,868.8	169.3	283.2	168.7	550.6	--	697.0	--
Vaccinum	9,188.8	340.1	140.3	5,123.8	2,069.1	--	1,192.4	323.1
Honeysuckle	33.1	--	--	33.1	--	--	--	--
Poison ivy	1,692.1	--	--	859.0	477.3	--	355.8	--
Grape	79.6	--	--	39.8	39.8	--	--	--
Total	14,306.0	1,315.7	442.9	6,362.1	3,462.8	--	2,399.4	323.1
All shrubs	134,948.0	4,774.9	14,580.9	40,289.3	34,659.6	--	38,938.2	1,705.1
State total	885,320.9	4,774.9	131,855.1	112,780.8	34,720.3	32,410.4	548,813.0	19,966.4

✪ U.S. GOVERNMENT PRINTING OFFICE: 1982-565-878/203

NORTH DAKOTA
1980

Jakes, Pamela J., and W. Brad Smith.
1982. A second look at North Dakota's timber lands, 1980. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-58, 86 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

The second inventory of North Dakota forest resources shows a decline in commercial forest area between 1954 and 1980. Presented are text and statistics on forest area and timber volume, growth, mortality, ownership, stocking, future timber supply, timber use, forest management opportunities, and nontimber forest resources. A forest type map is included.

KEY WORDS: timber volume, growth, utilization, forest areas.

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Pulpwood Production in the North-Central Region by County, 1980

James E. Blyth and W. Brad Smith

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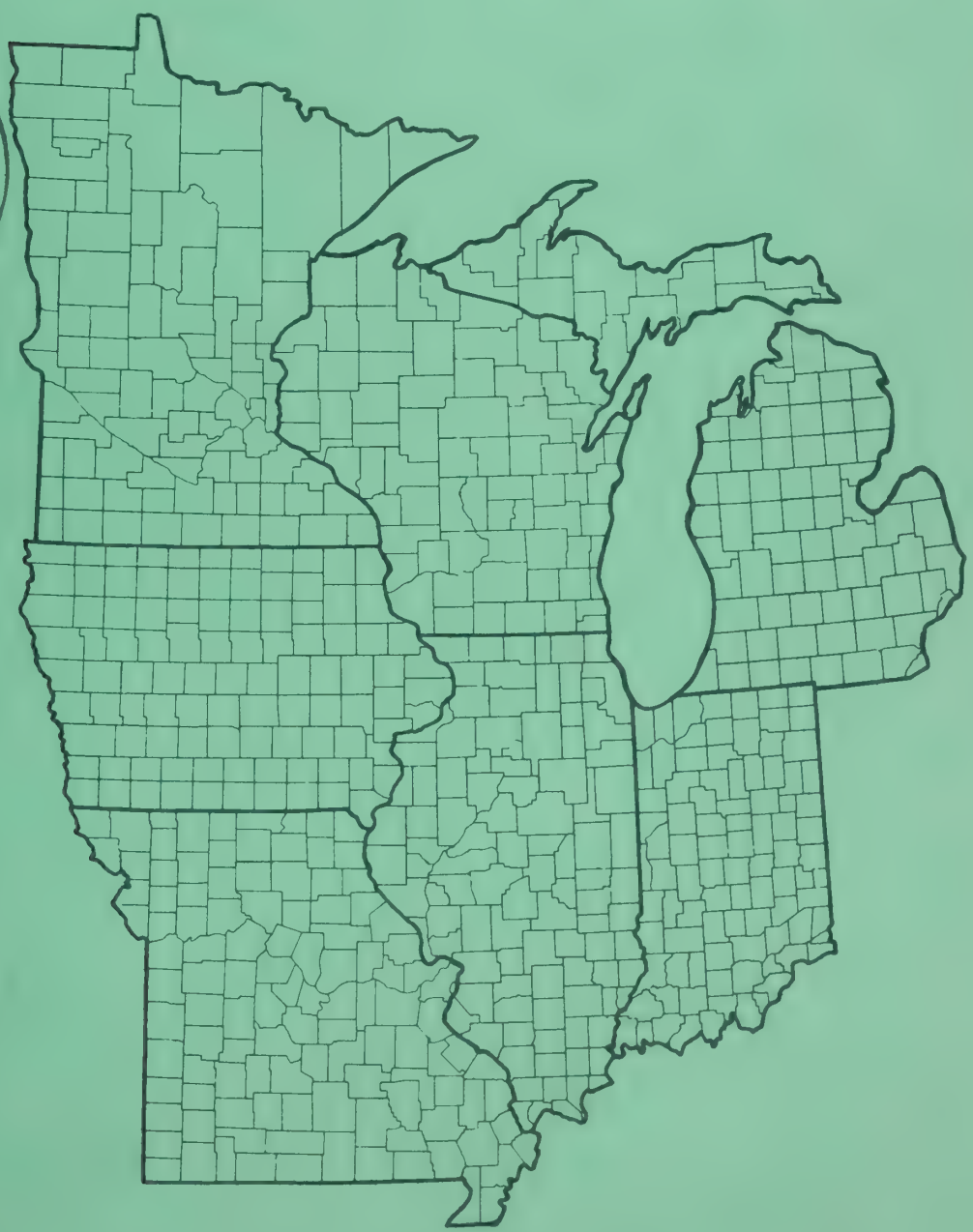

North Central Forest Experiment Station
Forest Service—U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108
Manuscript approved for publication April 26, 1982
1982

HIGHLIGHTS
Lake States

Pulpwood production climbed to 5.66 million cords in 1980. Birch output exceeded 300,000 cords for the first time. Loggers also cut record amounts of red pine, white pine, hard maple, balsam poplar, ash, and basswood. Jack pine was the only major loser. Eight percent of total production was whole-tree chips; Michigan continued to be the leading producer.

Total production rose 12 percent in Wisconsin, remained steady in Michigan, and declined 9 percent in Minnesota. Minnesota set another modern-day low in pine output.

Canadian softwood residue was imported in record quantities for the 8th consecutive year; Wisconsin was the principal customer.

Central States

Central States pulpwood production was 430,000 cords, only 90 percent of the 1979 volume. Soft hardwood output was the lowest recorded in this annual series. Softwood roundwood production reached another peak. Exports from the Central States broke the previous record.

Pulpwood receipts, the lowest since 1960, were off 25 percent at 221,000 cords. Several mills had weak demand for their building materials products. One mill closed permanently.

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PULPWOOD PRODUCTION IN THE NORTH CENTRAL REGION BY COUNTY, 1980

James E. Blyth, *Principal Market Analyst,*
and **W. Brad Smith,** *Mensurationist*

This is the 22nd annual report of the pulpwood vest in Lake States counties and the 21st annual ort of the Central States harvest. Pulpwood con- utes more than half the timber products har- ted annually in the Lake States (Michigan, Min- ota, and Wisconsin) and is an important product the Central States (Illinois, Indiana, Iowa, and ssouri).

Current detailed pulpwood production[1] informa- n is necessary for intelligent planning and deci- nmaking in wood procurement, forest resource nagement, and forest industry development. Also, earchers need current pulpwood information for nning projects.

Since 1979, logs, bolts and wood residue used manufacturing particleboard and wafer- ard are included in this annual series. Wood d at composition board plants is identical or nearly ntical to wood used at pulpmills.

Because composition board plants primarily use en and wood residue, their inclusion does not dis- t roundwood use trends for other species nor pre- de comparing survey results with 1978 and pre- us years.

Pulpmills, particleboard plants, and waferboard nts using North Central States timber in 1980 orted their pulpwood receipts[2] by species groups l counties of origin. This report presents the re- ts of the survey, analyzes the data where appro- ate, compares results with 1979 or earlier years, l discusses trends in pulpwood production and use.

The Lake States and Central States are discussed separately because the timber types in each area are different and less information can be released about the Central States (more detailed data on pulpwood production and receipts in the Central States would reveal the operations of individual mills).

Pulpwood production in Minnesota is completely and accurately shown. However, to prevent disclosure of confidential information about softwood pulpwood use by individual companies, the total quantity of softwood pulpwood imports and exports between Minnesota and Canada is not reported. Thus, some Minnesota softwood shipped to Canada is shown as remaining and used in Minnesota, and receipts of Canadian softwood in Minnesota are understated.

LAKE STATES
Production

Pulpwood production rose 2 percent from 1979 to 5.66 million cords in 1980 (table 1). Roundwood (including chips from roundwood) provided 9 out of 10 cords; the remainder was residue from local wood-using plants.[3]

Principal species cut were aspen (2,278,000 cords), jack pine (489,000 cords) and balsam fir (322,000 cords). Other notable species, each providing 200,000 to 300,000 cords, were red pine, spruce, hard maple, white birch, and soft maple.

Important harvest increases included hard maple (65,000 cords), spruce (49,000 cords), and white birch (40,000 cords). Spruce recovered from production near its 30-year low in 1979. Birch harvesting surpassed

---

[1] *Pulpwood production, determined from mill re- ots, is the annual volume of pulpwood cut in a cific county or region, plus the annual wood res- e volume produced by sawmills, veneer mills, etc., a specific State or region that was used for pulp l composition board manufacturing.*

[2] *Pulpwood receipts are the volume of wood received mills in a specific State or region, regardless of geographic source.*

[3] *Residue is the byproduct from sawmills, veneer mills, cooperage mills, and other wood-using plants that is used for pulping. Residue includes slabs, edgings, veneer cores, sawdust, wood flour, and chips manufactured from slabs, edgings, and veneer cores.*

Table 1.--Production and imports of pulpwood, Lake States, 1980

(In standard cords, unpeeled)

Species and destination	Production by States[1]				Imports			
	Michigan	Minnesota	Wisconsin	Regional total	Other U.S.[2]	Canada	Total imports	Total receipts
ROUNDWOOD								
Cedar								
Michigan	7,302	0	90	7,392	0	0	0	7,392
Total	7,302	0	90	7,392	0	0	0	7,392
Balsam fir								
Michigan	48,896	0	1,594	50,490	0	0	0	50,490
Minnesota	0	79,720	0	79,720	0	0	0	79,720
Wisconsin	44,372	2,743	99,887	147,002	0	285	285	147,287
Exported[3]	15,996	28,514	0	44,510	0	0	0	0
Total	109,264	110,977	101,481	321,722	0	285	285	277,497
Hemlock								
Michigan	49,466	0	2,899	52,365	0	0	0	52,365
Wisconsin	8,737	0	31,273	40,010	0	0	0	40,010
Total	58,203	0	34,172	92,375	0	0	0	92,375
Jack pine								
Michigan	110,054	0	833	110,887	0	0	0	110,887
Minnesota	0	85,773	0	85,773	0	244	244	86,017
Wisconsin	45,493	25,015	208,420	278,928	33,222[4]	0	33,222[4]	312,150[5]
Exported[3]	2,703	10,021	1,120	13,844	0	0	0	0
Total	158,250	120,809	210,373	489,432	33,222	244	33,466	509,054
Red pine								
Michigan	76,372	0	765	77,137	0	0	0	77,137
Minnesota	0	13,091	0	13,091	0	0	0	13,091
Wisconsin	15,505	9,874	157,589	182,968	61	0	61	183,029
Total	91,877	22,965	158,354	273,196	61	0	61	273,257
White pine								
Michigan	13,216	0	496	13,712	0	0	0	13,712
Minnesota	0	6,512	0	6,512	0	0	0	6,512
Wisconsin	4,150	109	18,165	22,424	0	0	0	22,424
Total	17,366	6,621	18,661	42,648	0	0	0	42,648
Spruce								
Michigan	27,245	0	205	27,450	0	0	0	27,450
Minnesota	0	122,235	0	122,235	0	5,843	5,843	128,078
Wisconsin	17,467	38,181	32,291	87,939	0	5,870	5,870	93,809
Exported[3]	12,952	9,454	0	22,406	0	0	0	0
Total	57,664	169,870	32,496	260,030	0	11,713	11,713	249,337
Tamarack								
Michigan	4,672	0	8	4,680	0	0	0	4,680
Minnesota	0	13,036	0	13,036	0	770	770	13,806
Wisconsin	1,086	29,494	3,434	34,014	0	0	0	34,014
Total	5,758	42,530	3,442	51,730	0	770	770	52,500
Ash								
Michigan	11,863	0	3	11,866	0	0	0	11,866
Wisconsin	5,394	351	40,090	45,835	0	0	0	45,835
Exported[3]	0	1	92	93	0	0	0	0
Total	17,257	352	40,185	57,794	0	0	0	57,701
Aspen								
Michigan	525,347	0	0	525,347	0	0	0	525,347
Minnesota	0	594,943	17,863	612,806	0	198	198	613,004
Wisconsin	179,621	83,997	854,856	1,118,474	0	0	0	1,118,474
Exported[3]	0	20,448	429	20,877	0	0	0	0
Total	704,968	699,388	873,148	2,277,504	0	198	198	2,256,825
Balsam poplar								
Michigan	18,646	0	0	18,646	0	0	0	18,646
Minnesota	0	46,491	0	46,491	0	0	0	46,491
Total	18,646	46,491	0	65,137	0	0	0	65,137
Basswood								
Michigan	16,462	0	0	16,462	0	0	0	16,462
Minnesota	0	55	0	55	0	0	0	55
Wisconsin	847	8	19,931	20,786	0	0	0	20,786
Exported[3]	0	1	173	174	0	0	0	0
Total	17,309	64	20,104	37,477	0	0	0	37,303
Beech								
Michigan	17,811	0	20	17,831	0	0	0	17,831
Wisconsin	1,075	0	37	1,112	0	0	0	1,112
Total	18,886	0	57	18,943	0	0	0	18,943
White birch								
Michigan	62,910	0	268	63,178	0	0	0	63,178
Minnesota	0	165	0	165	0	0	0	165
Wisconsin	16,052	15,080	161,651	192,783	0	0	0	192,783
Exported[3]	0	0	141	141	0	0	0	0
Total	78,962	15,245	162,060	256,267	0	0	0	256,126
Yellow birch								
Michigan	10,188	0	0	10,188	0	0	0	10,188
Wisconsin	14,341	0	23,412	37,753	0	0	0	37,753
Total	24,529	0	23,412	47,941	0	0	0	47,941
Cottonwood								
Exported[3]	0	0	30	30	0	0	0	0
Total	0	0	30	30	0	0	0	0
Elm								
Michigan	17,352	0	19	17,371	0	0	0	17,371
Wisconsin	22,306	37	99,653	121,996	0	0	0	121,996
Exported[3]	0	213	496	709	0	0	0	0
Total	39,658	250	100,168	140,076	0	0	0	139,367

(Table 1 continued on next page)

(Table 1 continued)

Species and destination	Production by States[1]				Imports			
	Michigan	Minnesota	Wisconsin	Regional total	Other U.S.[2]	Canada	Total imports	Total receipts
ROUNDWOOD (cont)								
Hickory								
Wisconsin	0	0	636	636	0	0	0	636
Total	0	0	636	636	0	0	0	636
Hard maple								
Michigan	73,999	0	281	74,280	0	0	0	74,280
Wisconsin	49,954	873	152,372	203,199	0	0	0	203,199
Exported[3]	0	3	167	170	0	0	0	0
Total	123,953	876	152,820	277,649	0	0	0	277,479
Soft maple								
Michigan	124,174	0	208	124,382	0	0	0	124,382
Wisconsin	23,203	172	55,734	79,109	0	0	0	79,109
Exported[3]	0	0	474	474	0	0	0	0
Total	147,377	172	56,416	203,965	0	0	0	203,491
Red oak								
Michigan	93,305	0	13	93,318	0	0	0	93,318
Wisconsin	2,477	0	59,471	61,948	0	0	0	61,948
Exported[3]	0	2	1,255	1,257	0	0	0	0
Total	95,782	2	60,739	156,523	0	0	0	155,266
White oak								
Michigan	6,287	0	0	6,287	0	0	0	6,287
Wisconsin	462	0	19,307	19,769	0	0	0	19,769
Exported[3]	0	4	474	478	0	0	0	0
Total	6,749	4	19,781	26,534	0	0	0	26,056
Other hardwoods								
Michigan	12,744	0	39	12,783	0	0	0	12,783
Wisconsin	2,881	0	4,458	7,339	0	0	0	7,339
Exported[3]	0	0	42	42	0	0	0	0
Total	15,625	0	4,539	20,164	0	0	0	20,122
Total roundwood								
Michigan	1,328,311	0	7,741	1,336,052	0	0	0	1,336,052
Minnesota	0	962,021	17,863	979,884	0	7,055	7,055	986,939
Wisconsin	455,423	205,934	2,042,667	2,704,024	33,283	6,155	39,438	2,743,462
Exported[3]	31,651	68,661	4,893	105,205	0	0	0	0
Total	1,815,385	1,236,616	2,073,164	5,125,165	33,283	13,210	46,493	5,066,453
RESIDUE, SOFTWOOD								
Michigan	8,215	0	0	8,215	0	2,957	2,957	11,172
Minnesota	0	29,311	0	29,311	19,991	2,054	22,045	51,356
Wisconsin	6,912	2,103	38,200	47,215	135,026	85,534	220,560	267,775
Exported[3]	116	2,503	1,279	3,898	0	0	0	0
Total	15,243	33,917	39,479	88,639	155,017	90,545	245,562	330,303
RESIDUE, HARDWOOD								
Michigan	105,883	0	27,270	133,153	12,498	0	12,498	145,651
Minnesota	0	52,459	0	52,459	0	5,829	5,829	58,288
Wisconsin	27,760	8,033	216,649	252,442	1,986	0	1,986	254,428
Exported[3]	4,381	2,266	5,386	12,033	0	0	00	0
Total	138,024	62,758	249,305	450,087	14,484	5,829	20,313	458,367
ALL WOOD MATERIAL								
Michigan	1,442,409	0	35,011	1,477,420	12,498	2,957	15,455	1,492,875
Minnesota	0	1,043,791	17,863	1,061,654	19,991	14,938	34,929	1,096,583
Wisconsin	490,095	216,070	2,297,516	3,003,681	170,295	91,689	261,984	3,265,665
Exported[3]	36,148	73,430	11,558	121,136	0	0	0	0
Total	1,968,652	1,333,291	2,361,948	5,663,891	202,784	109,584	312,368	5,855,123

[1]/Vertical columns of figures under box heading "Production by States" present the amount of pulpwood cut in each State.
[2]/Mostly western States.
[3]/Pulpwood shipped to mills outside of region.
[4]/Ponderosa pine.
[5]/Includes ponderosa pine from other U.S.

)0,000 cords for the first time. Other record har-sts included red pine, white pine, hard maple, bal-m poplar, ash, and basswood. Balsam fir produc-)n was the highest since 1960.

Jack pine output fell 110,000 cords, the only major)ecies to decline. Rising production in other soft-)ods more than offset the jack pine decline.

Lake States loggers produced 447,000 cords of hole-tree chips,[4] 17 percent more than in 1979, and percent of the pulpwood from all sources in 1980. hole-tree chips constituted 1 out of every 6 cords oduced in Michigan. Production of whole-tree chips ' species group and State was:

State	Softwoods	Aspen	Other hardwoods
	(Thousand cords)		
Michigan	12.8	189.3	125.2
Minnesota	—	98.3	8.8
Wisconsin	1.1	8.6	3.4

Michigan.—Michigan supplied 1.97 million cords of pulpwood, down slightly from 1979. Jack pine production plunged 40 percent, but gains were recorded in all other softwood groups, except cedar. Delta, Marquette, Iron, and Menominee counties each produced more than 100,000 cords.

Minnesota.—Minnesota production fell 125,000 cords to 1.33 million. Ninety-two percent of the hardwood harvest was aspen, although aspen demand dropped sharply. The pine cut declined beyond the

[4] *Pulpwood produced from chipping entire trees (all)rtions of trees above ground, except the stumps).*

previous modern-day low set in 1979. During recent years the trend has been down in the jack pine harvest and up in red pine. Top-producing counties were St. Louis, Koochiching, and Itasca.

Wisconsin.—Demand for Wisconsin pulpwood climbed to 2.36 million cords, led by record high demand for aspen, pine, balsam fir, and birch. Wisconsin wood-using mills supplied nearly one-quarter million cords of hardwood residue to pulpmills. Marinette, Oneida, Forest, and Price were the leading pulpwood-producing counties.

The distribution of the harvest is shown in two ways: first, the amount of pulpwood cut relative to the growing stock volume in major pulpwood species (fig. 1); and second, the amount of pulpwood cut relative to commercial forest area (fig. 2). Cutting pressure increased more in Northeastern Wisconsin than elsewhere. Other areas with heavy cutting were Central Wisconsin and all parts of Michigan except the Southern Lower Peninsula.

Receipts

Thirty-eight pulpmills, three particleboard plan and three waferboard plants received 5.86 milli cords of pulpwood in 1980. Thirty-nine out of 43 erating mills used aspen and 21 used hardwood r idue, 2 more than in 1979. (table 2).

Canada shipped record supplies of softwood re due to the Lake States for the eighth consecuti year; Wisconsin was the chief customer. Softwo residue procured in the Lake States from other are of the U.S. plunged to the lowest level since 197 major suppliers were South Dakota and Wyomin

Michigan.—Only 3 percent of the 1.49 milli cords received were from out-of-State. Hardwood r idue was the primary import. Aspen, soft maple, a jack pine were the species most in demand.

Wisconsin.—Of the 3.27 million cords receiv 490,000 cords came from Michigan, 216,000 cor

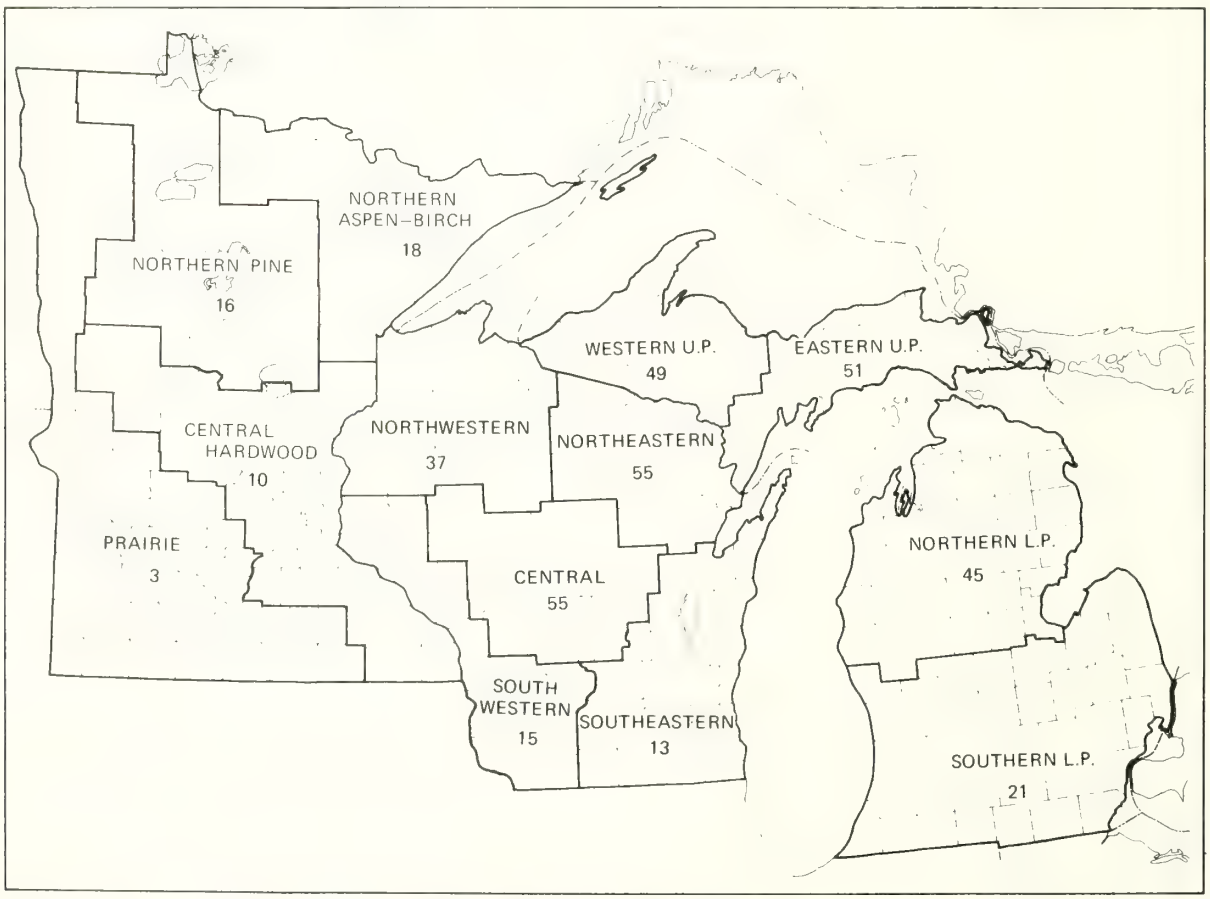


Figure 1.—*Cords of pulpwood (including chips from roundwood) harvested per 1,000 cords of merchantable volume in principal pulpwood species by Forest Inventory Unit, 1980. Merchantable volume was determined during the last forest inventory in each State.*

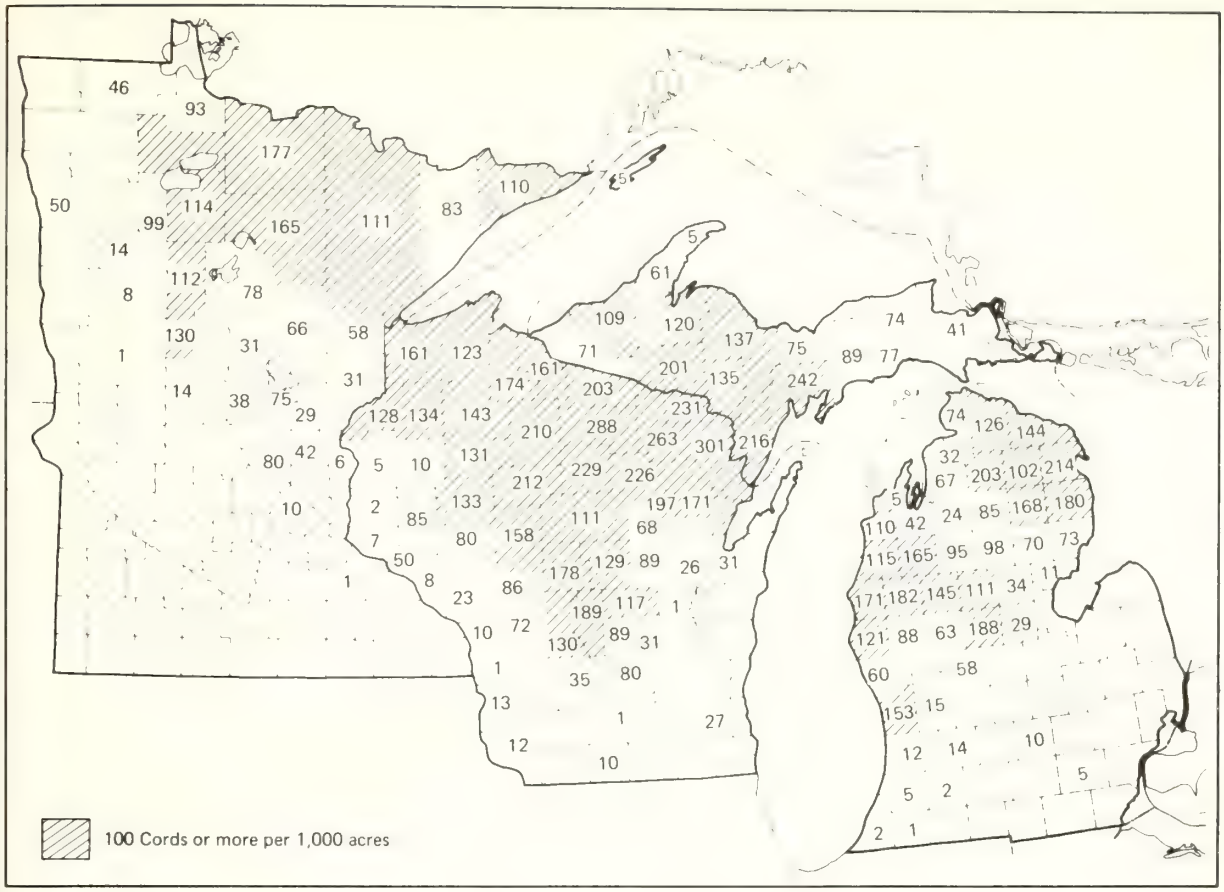


Figure 2.—*Cords of pulpwood cut per 1,000 acres of stocked commercial forest land in principal pulpwood-producing counties, 1980. Acres of stocked commercial forest land were determined during the last forest inventory in each State.*

ne from Minnesota, 170,000 cords came from other imarily western) States, and 92,000 cords came m Canada. Out-of-State sources provided two-thirds the spruce and nine-tenths of the tamarack re- irements. Canada and States outside the Lake ates area furnished 82 percent of the softwood res- ue demand.

ndustry Trends and Analysis

Average daily pulp production was 10,505 tons ble 3). Two pulpmills, one in Michigan and one in nnesota closed during 1979. Wisconsin's average ily pulp production was greater than similar pro- ction in Michigan and Minnesota combined.

Annual production capacity at particleboard and iferboard plants was 365 million square feet:

Company	Location	Capacity Million square feet (3/4 inch basis)
Champion International Corp.	Gaylord, MI	175
Blandin Wood Products Co.	Grand Rapids, MN	45
Louisiana-Pacific Corp.	Hayward, WI	65
Weyerhaeuser Co.	Marshfield, WI	65
Rodman Industries	Marinette, WI	15

One plant is tripling its capacity and another is doubling capacity. Meanwhile, a new plant neared completion in 1980 and three others will be completed between 1981 and 1984. One operating particleboard plant may close. During the last decade, softwood pulpwood production as a percent of total production has been relatively steady, ranging from 28 to 36 percent. Similarly, no trend has developed

[5]*Directory of the Forest Products Industry, 1981.*

Table 2.--Numbers of industrial plants in the Lake States using a particular species or residue for pulping and composition board in 1980

Species and kind of material	Total Lake States	Michigan	Minnesota	Wisconsin
Aspen	39	8	9	22
Balsam fir	15	3	5	7
Birch	20	6	-	14
Hemlock	8	2	-	6
Pine	10	4	2	4
Spruce	14	2	5	7
Tamarack	7	1	2	4
Maple	17	7	-	10
Oak	15	7	-	8
Other hardwoods	21	7	4	10
Softwood residue	14	2	2	10
Hardwood residue	21	7	2	12
Total plants[1/]	43	8	9	26

[1/] Some plants use more than one species, so numbers in columns cannot be added.

in hardwood pulpwood output from residue as compared with roundwood. However, softwood pulpwood production from residue has increased from 3 to 4 percent of all softwood in the early 70's to 5 to 7 percent in recent years.

CENTRAL STATES
Production

Pulpwood production fell 10 percent from 1979 to 430,000 cords (table 4). Notable declines included 26,000 cords in soft hardwoods and 25,000 cords in hardwood residue. Output from soft hardwoods was the lowest since annual production studies were established in 1955. Softwood roundwood production reached another high as thinnings continued in pine plantations. Exports from the Central States, chiefly hardwood residue, topped all previous years. Mills in Kentucky, Michigan, Ohio, Wisconsin, Oklahoma, and Tennessee procured 55 percent of the production.

Output fell in Iowa and Indiana, the leading producer; remained steady in Illinois; and climbed moderately in Missouri. Illinois harvested more softwood pulpwood than ever; no other records were broken.

Loggers harvested pulpwood in 38 Illinois cou-ties, 25 Indiana counties, 18 Missouri counties, a 10 Iowa counties (fig. 3). Logging areas expanded southern Illinois, southern Indiana, and northea-ern Missouri and contracted in northern Illinc eastern Iowa, and southeastern Missouri.

Receipts

Twelve Central States pulpmills received 221,0 cords, down 25 percent from 1979, and the low since 1960. Ten of the 12 mills produce home-bui ing materials. Declining demand at these mills building products led to lower pulpwood requi ments. Imports were nearly halved from 1979 a constituted only 13 percent of the total receipts co pared with 19 percent in 1979. Most of the cutba in imports was at Illinois mills where total receip from all sources were the lowest recorded since a nual pulpwood studies began in 1955. Twelve Stat mostly Lake and southern States, shipped wood Central States mills.

Table 3.--Active woodpulp mills in the Lake States, by location, type of pulp produced, and average daily production, 1980

(In tons per 24 hours)[1/]

pany	Location	Average production				
		Total	Sulfite	Kraft	Groundwood and other mechanical	Semi-chemical
higan						
bitibi-Price Inc.	Alpena	430	0	0	430	0
hampion International	Ontonagon	440	0	0	0	440
anistique Pulp And Paper Co.	Manistique	90	0	0	90	0
ead Corp.	Escanaba	750	0	600	150	0
enasha Corp.	Otsego	225	0	0	0	225
ackaging Corp Of America	Filer City	600	0	0	0	600
arren Co., S.D.	Muskegon	250	0	250	0	0
Total	7 plants	2,785	0	850	670	1,265
nesota						
landin Paper Co.	Grand Rapids	325	0	0	325	0
ennepin Paper Co.	Little Falls	75	0	0	75	0
oise Cascade Corp.	International Falls	890	0	350	540	0
otlatch Corp.	Cloquet	440	0	440	0	0
uperwood Corp.	Bemidji	90	0	0	90	0
t Regis Paper Co.	Sartell	135	0	0	135	0
uperwood Corp.	Duluth	350	0	0	350	0
onwed Corp.	Cloquet	55	0	0	55	0
Total	8 plants	2,360	0	790	1,570	0
consin						
merican Can Co.	Green Bay	210	150	0	60	0
eyerhaeuser Co.	Rothschild	210	210	0	0	0
adger Paper Mills	Peshtigo	110	110	0	0	0
ppleton Papers, Inc.	Combined Locks	200	0	0	200	0
onsolidated Papers, Inc.	Appleton	130	130	0	0	0
onsolidated Papers, Inc.	Stevens Point	230	0	0	230	0
onsolidated Papers, Inc.	Wisconsin Rapids	780	0	465	315	0
reen Bay Packaging, Inc.	Green Bay	200	0	0	0	200
lambeau Paper Co.	Park Falls	110	110	0	0	0
idtec Paper Corp.	Kimberly	150	0	0	150	0
entair Industries	Niagara	170	0	0	170	0
osinee Paper Mills Co.	Mosinee	200	0	200	0	0
ekoosa Papers, Inc.	Nekoosa	335	0	335	0	0
ekoosa Papers, Inc.	Port Edwards	235	235	0	0	0
wens-Illinois	Tomahawk	1,000	0	0	0	1,000
rocter and Gamble, Inc.	Green Bay	(2/)	(2/)	(2/)	(2/)	(2/)
hinelander Paper Co.	Rhinelander	75	75	0	0	0
lintkote Co.	Cornell	100	0	0	100	0
uperior Fiber Products Co.	Superior	180	0	0	180	0
hilmany Pulp and Paper Co.	Kaukauna	400	0	400	0	0
omahawk Pulp Co., Inc.	Tomahawk	50	0	0	50	0
ausau Paper Mills Co.	Brokaw	185	185	0	0	0
uperwood	Phillips	100	0	0	100	0
Total	23 plants	5,360	1,205	1,400	1,555	1,200
states	38 plants	10,505	1,205	3,040	3,795	2,465

1/ Lockwood's Directory of the Paper and Allied Industries, 1981
2/ Capacity not available.

Table 4.--Production and imports of pulpwood, Central States, 1980

(In standard cords, unpeeled)[1/]

Species and destination	Production by States [2/]					Imports			
	Illinois	Indiana	Iowa	Missouri	Regional total	Lake States	Other U.S.	Total imports	Total receipts
ROUNDWOOD									
Softwoods									
Illinois	8,439	1,400	0	714	10,553	1,120	0	1,120	11,673
Indiana, Iowa, Missouri[3/]	0	0	0	0	0	0	5,200	5,200	5,200
Exported[4/]	10,029	0	61	52	10,142	0	0	0	0
Total	18,468	1,400	61	766	20,695	1,120	5,200	6,320	16,873
Soft hardwoods									
Illinois	5,232	578	0	0	5,810	656	720	1,376	7,186
Indiana, Iowa, Missouri[3/]	3,186	12,536	6,169	9,211	31,102	1,350	1,561	2,911	34,013
Exported[4/]	4,914	502	0	726	6,142	0	0	0	0
Total	13,332	13,616	6,169	9,937	43,054	2,006	2,281	4,287	41,199
Hard hardwoods									
Illinois	160	0	0	0	160	0	0	0	160
Indiana, Iowa, Missouri[3/]	4,866	12,469	10,554	3,721	31,610	1,997	1,553	3,550	35,160
Exported[4/]	20,008	12,789	0	10,260	43,057	0	0	0	0
Total	25,034	25,258	10,554	13,981	74,827	1,997	1,553	3,550	35,320
Total roundwood									
Illinois	13,831	1,978	0	714	16,523	1,776	720	2,496	19,019
Indiana, Iowa, Missouri[3/]	8,052	25,005	16,723	12,932	62,712	3,347	8,314	11,661	74,373
Exported[4/]	34,951	13,291	61	11,038	59,341	0	0	0	0
Total	56,834	40,274	16,784	24,684	138,576	5,123	9,034	14,157	93,392
RESIDUE, SOFTWOOD									
Illinois	303	0	419	42	764	2,077	1,351	3,428	4,192
Exported[4/]	589	0	4,567	2,282	7,438	0	0	0	0
Total	892	0	4,986	2,324	8,202	2,077	1,351	3,428	4,192
RESIDUE, HARDWOOD									
Illinois	7,110	6,724	0	5,511	19,345	4,381	0	4,381	23,726
Indiana, Iowa, Missouri[3/]	15,495	34,928	22,459	18,666	91,548	7,652	0	7,652	99,200
Exported[4/]	22,086	96,008	80	54,250	172,424	0	0	0	0
Total	44,691	137,660	22,539	78,427	283,317	12,033	0	12,033	122,926
ALL WOOD MATERIAL									
Illinois	21,244	8,702	419	6,267	36,632	8,234	2,071	10,305	46,937
Indiana, Iowa, Missouri[3/]	23,547	59,933	39,182	31,598	154,260	10,999	8,314	19,313	173,573
Exported[4/]	57,626	109,299	4,708	67,570	239,203	0	0	0	0
Total	102,417	177,934	44,309	105,435	430,095	19,233	10,385	29,618	220,510

[1/]Factors used in converting to standard green cords (128 cubic feet) were:
4,500 pounds of soft hardwood roundwood;
5,000 pounds of hard hardwood or coniferous roundwood;
4,100 pounds of softwood chips (green);
4,400 pounds of hardwood chips (green);
2,500 pounds of chips (all species, dry).

[2/]Vertical columns of figures under box heading "Production by States" present the amount of pulpwood cut in each State.

[3/]Combined to prevent disclosure of individual mill receipts.

[4/]Pulpwood shipped to mills outside the region.

Industry Trends and Analysis

Average daily pulp production continued at 1,150 tons per day (table 5). One mill closed permanently in 1980, another closed temporarily for part of the year, and at least one other may close temporarily due to slackening demand for products. Mill ownership remained unchanged and no firms announced significant mill expansions or new mill construction.

Softwood production continue to climb, accounting for 15 percent of all roundwood produced. Use of Central States hardwood residue by pulpmills ros rapidly from 1965 to 1976, then stabilized near 300,00 cords annually. Fuelwood markets have compete strongly with pulpwood market.

Although pulpwood exports peaked in 1980, the have remained within a narrow 20,000-cord devia tion since 1976 and are not likely to increas significantly during the next 3 years. Mills usin Central States wood are not planning any major ex pansion.

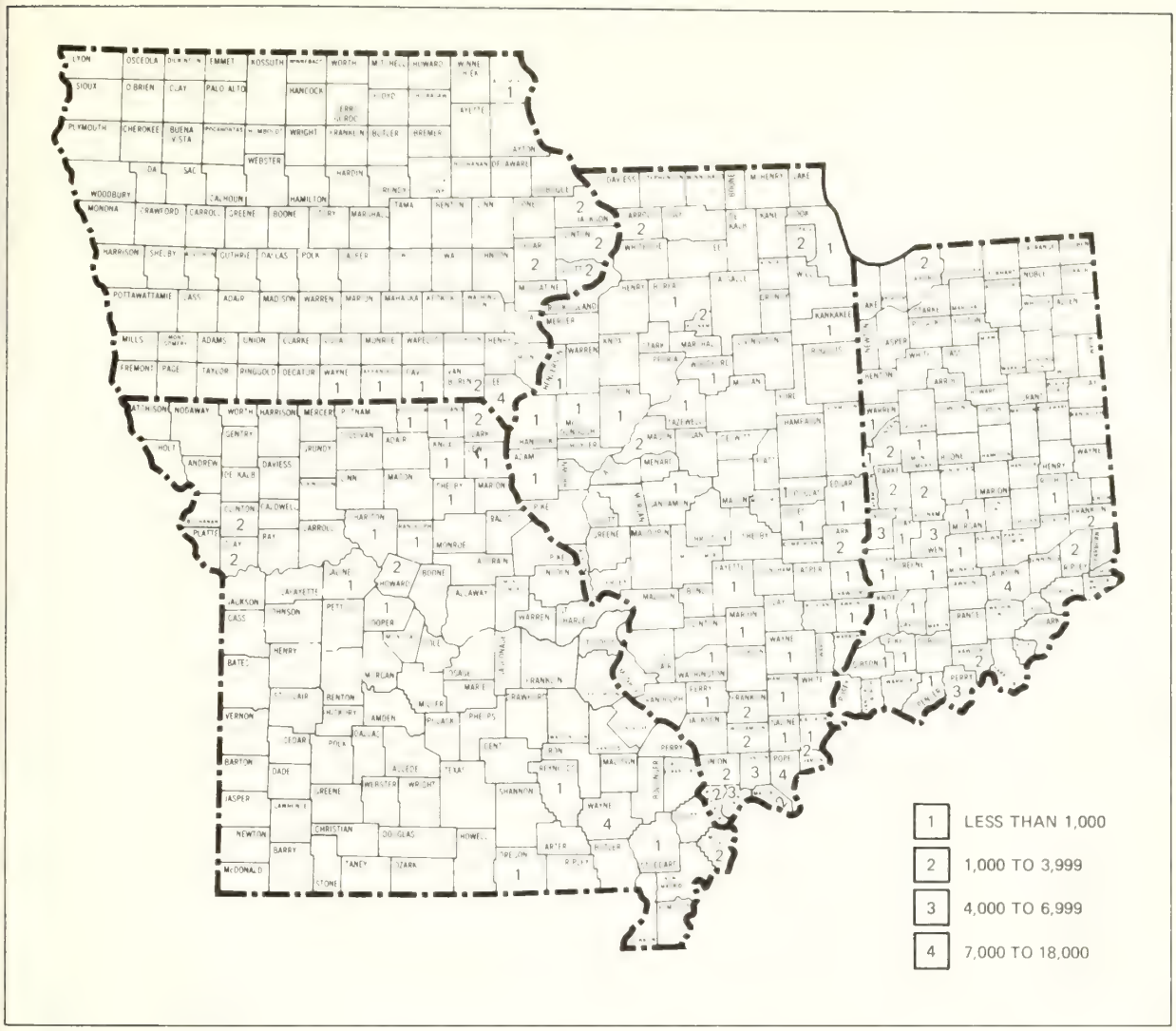


Figure 3.—*Harvest of pulpwood (including chips from roundwood) in the Central States by counties, in standard cords, 1980.*

Table 5.--Active woodpulp mills in the Central States, by location, type of pulp produced, and average daily production, 1980

(In tons per 24 hours)[1/]

Company	Location	Average production				
		Total	Sulfite	Kraft	Groundwood and other mechanical	Semi-chemical
ILLINOIS						
Bird and Son, Inc.	Chicago	40	0	0	40	0
Celotex Corp.	Peoria	90	0	0	90	0
Certain-Teed Products Corp.	East St. Louis	100	0	0	100	0
Flintkote Co., The	Mt. Carmel	40	0	0	40	0
GAF Corp.	Joliet	150	0	0	150	0
Celotex Corp.	Wilmington	30	0	0	30	0
Total	7 plants	500	0	0	500	0
INDIANA						
Weston Paper and Mfg. Co.	Terre Haute	270	0	0	0	270
Total	1 plant	270	0	0	0	270
IOWA						
Celotex Corp.	Dubuque	90	0	0	90	0
Consolidated Packaging Corp.	Fort Madison	140	0	0	0	140
Total	2 plants	230	0	0	90	140
MISSOURI						
GAF Corp.	Kansas City	90	0	0	90	0
Huebert Fibreboard, Inc.	Booneville	60	0	0	60	0
Total	2 plants	150	0	0	150	0
All States	12 plants	1,150	0	0	740	410

1/ Lockwood's Directory of the Paper and Allied Industries, 1981.
2/ Capacity not available.

APPENDIX

Table 6.--Lake States pulpwood production[1/] by State of origin and destination, 1976-1980

(In thousand standard cords, unpeeled)

MICHIGAN

	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
1976	1,541	-	414	1,081	26
1977	1,595	-	407	1,159	29
1978	1,675	-	404	1,248	23
1979	1,981	(2/)	516	1,428	37
1980	1,969	-	490	1,443	36
5 year average	1,752	(2/)	450	1,272	30

MINNESOTA

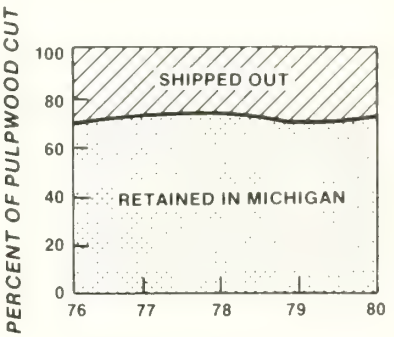
	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
1976	1,309	1,109	182	-	18
1977	1,313	1,149	154	-	30
1978	1,338	1,155	162	-	21
1979	1,458	1,276	169	-	63
1980	1,333	1,044	216	-	73
5 year average	1,354	1,137	176	-	41

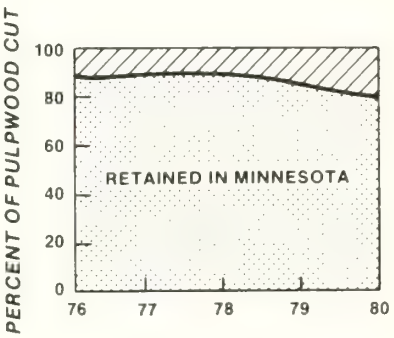
WISCONSIN

	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
1976	1,840	23	1,784	24	9
1977	1,816	26	1,714	64	12
1978	1,895	26	1,779	70	20
1979	2,109	20	2,024	47	18
1980	2,362	18	2,297	35	12
5 year average	2,004	23	1,919	48	14

1/Production in 1976-1978 does not include wood for particleboard or waferboard plants.

2/Less than 500 cords.





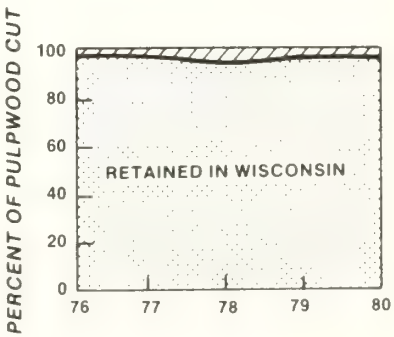


Table 7.--Lake States pulpwood production from roundwood by forest inventory unit and destination by State, 1980

(In hundred standard cords, unpeeled)

Unit	Total cut	Destination of pulpwood			
		Michigan	Minnesota	Wisconsin	Other
MICHIGAN					
E. Upper Peninsula	4,692	2,964	0	1,483	245
W. Upper Peninsula	5,660	2,720	0	2,940	0
N. Lower Peninsula	7,454	7,251	0	131	72
S. Lower Peninsula	349	349	0	0	0
Total roundwood	18,155	13,284	0	4,554	317
Total residue	1,533	1,141	0	347	45
Total	19,688	14,425	0	4,901	362
MINNESOTA					
Aspen-Birch	6,413	0	4,775	954	684
Northern Pine	5,520	0	4,537	983	0
Central Hardwood	399	0	306	91	2
Prairie	34	0	3	31	0
Total roundwood	12,366	0	9,621	2,059	686
Total residue	967	0	818	101	48
Total	13,333	0	10,439	2,160	734
WISCONSIN					
Northeastern	9,470	55	0	9,415	0
Northwestern	7,525	22	179	7,324	0
Central	3,346	0	0	3,330	16
Southwestern	275	0	0	242	33
Southeastern	116	0	0	116	0
Total roundwood	20,732	77	179	20,427	49
Total residue	2,888	273	0	2,548	67
Total	23,620	350	179	22,975	116

Table 8.--Lake States pulpwood production[1] from roundwood by species, State, and Forest Inventory Unit, 1976-1980.

(In thousand standard cords, unpeeled)

MICHIGAN

Unit	Aspen					Balsam fir					Birch					Hemlock				
	Annual production					Annual production					Annual production					Annual production				
	1976	1977	1978	1979	1980	1976	1977	1978	1979	1980	1976	1977	1978	1979	1980	1976	1977	1978	1979	1980
Eastern Upper Peninsula	93	106	103	125	116	41	48	44	43	57	20	22	28	35	29	35	31	24	26	32
Western Upper Peninsula	176	195	220	204	209	31	45	42	41	46	29	29	46	53	40	44	31	24	19	26
Northern Lower Peninsula	216	222	257	375	374	3	2	1	1	6	20	11	16	21	34	(2/)	(2/)	(2/)	-	(2/)
Southern Lower Peninsula	6	9	6	5	6	-	-	-	-	--	(2/)	(2/)	(2/)	(2/)	(2/)	-	-	-	-	-
Total	491	532	586	709	705	75	95	87	85	109	69	62	90	109	103	79	62	48	45	58

MINNESOTA

Aspen-Birch	372	375	363	392	313	44	60	59	72	73	21	15	2	3	11	-	-	-	-	-
Northern Pine	276	292	306	404	357	30	39	37	46	38	23	13	5	1	4	-	-	-	-	-
Central Hardwood	25	30	35	41	29	(2/)	-	-	(2/)	--	?	2	?	3	(2/)	-	-	-	-	-
Prairie	-	-	-	1	(2/)	-	-	-	-	--	-	-	-	-	-	-	-	-	-	-
Total	673	697	704	838	699	74	99	96	118	111	46	30	9	7	15	-	-	-	-	-

WISCONSIN

Northeastern	345	334	331	364	459	61	57	53	60	66	50	54	62	76	91	27	32	30	26	26
Northwestern	208	229	300	319	326	26	15	21	23	35	56	44	53	63	80	9	8	19	13	6
Central	35	31	37	66	85	2	1	1	1	1	3	5	6	11	15	7	3	4	1	?
Southwestern	-	1	1	1	1	-	-	-	-	--	-	(2/)	(2/)	(2/)	(2/)	-	-	-	-	-
Southeastern	?	1	(2/)	1	?	-	-	(2/)	-	--	(2/)	(2/)	(2/)	1	(2/)	-	-	-	-	-
Total	603	606	669	751	873	89	73	75	84	102	114	103	121	151	186	43	43	53	40	34
Lake States	1,967	1,935	1,959	2,298	2,277	238	267	258	287	322	229	195	220	267	304	122	105	101	85	92

(Table 8 continued on next page)

[1] Production in 1976-1978 does not include wood for particleboard or waferboard plants.
[2] Less than 500 cords.
[3] Includes small quantity of cedar not shown in other parts of table.

Table 8.--continued

MICHIGAN

Unit	Pine					Spruce					Tamarack					Other hardwoods				
	Annual production					Annual production					Annual production					Annual production				
	1976	1977	1978	1979	1980	1976	1977	1978	1979	1980	1976	1977	1978	1979	1980	1976	1977	1978	1979	1980
Eastern Upper Peninsula	88	92	85	119	70	17	27	25	21	34	(2/)	2	1	1	3	92	69	73	83	124
Western Upper Peninsula	43	49	50	48	53	14	21	18	17	23	1	1	1	1	3	88	84	134	174	163
Northern Lower Peninsula	140	119	122	166	124	1	(2/)	(2/)	1	1	-	-	-	-	-	147	162	179	194	206
Southern Lower Peninsula	10	12	20	17	21	-	-	-	-	-	-	-	-	-	-	3	18	3	5	8
Total	281	262	277	350	268	32	48	43	39	58	1	3	2	2	6	320	333	389	456	501

MINNESOTA

Aspen-Birch	104	97	89	75	66	129	110	126	119	127	19	24	18	18	22	19	12	17	18	30
Northern Pine	64	73	89	75	76	46	43	38	34	43	17	15	10	16	18	7	5	9	9	16
Central Hardwood	4	4	8	8	9	(2/)	(2/)	(2/)	(2/)	(2/)	(2/)	(2/)	-	(2/)	(2/)	6	8	13	4	2
Prairie	-	-	-	-	-	-	-	(2/)	-	(2/)	1	3	2	2	3	-	-	-	-	(2/)
Total	172	174	186	158	151	175	153	164	153	170	37	42	30	36	43	32	25	39	31	48

WISCONSIN

Northeastern	55	68	98	95	95	14	16	16	14	27	2	2	2	1	2	158	152	113	150	181
Northwestern	96	103	122	113	113	4	3	3	4	5	1	1	1	1	1	122	104	159	165	186
Central	124	113	121	127	149	1	(2/)	(2/)	(2/)	1	(2/)	1	(2/)	(2/)	(2/)	140	121	91	121	82
Southwestern	5	8	11	20	22	-	-	-	-	(2/)	-	-	-	-	-	3	4	8	4	4
Southeastern	6	4	5	6	8	-	-	-	1	(2/)	-	-	-	-	-	2	2	2	1	2
Total	286	296	357	361	387	19	19	19	19	33	3	4	3	2	3	425	383	373	441	455
Lake States	739	732	820	869	806	226	220	226	211	261	41	49	35	40	52	777	741	801	928	1004

(Table 8 continued on next page)

Table 8.--continued

MICHIGAN

Unit	All species3/ Annual production				
	1976	1977	1978	1979	1980
Eastern Upper Peninsula	379	390	387	457	469
Western Upper Peninsula	428	468	537	561	566
Northern Lower Peninsula	527	516	575	759	745
Southern Lower Peninsula	19	30	29	27	35
Total	1,353	1,403	1,528	1,804	1,815

MINNESOTA

Aspen-Birch	708	693	674	696	642
Northern Pine	463	480	494	585	562
Central Hardwood	37	44	58	56	40
Prairie	1	3	2	3	3
Total	1,209	1,220	1,228	1,340	1,237

WISCONSIN

Northeastern	712	716	706	786	947
Northwestern	622	608	678	701	752
Central	320	275	263	327	335
Southwestern	8	13	20	25	27
Southeastern	10	7	7	10	12
Total	1,672	1,619	1,671	1,849	2,073
Lake States	4,234	4,242	4,427	4,993	5,125

Table 9.--Lake States pulpwood production from roundwood by county and species, 1980

(In standard cords, unpeeled)

MICHIGAN

Unit and county[1/]	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tama-rack	Ash	Aspen	Balsam poplar	Bass-wood
E. UPPER PENINSULA												
Alger	444	3,156	4,207	4,235	4,008	1,155	2,266	333	153	3,799	503	197
Chippewa	273	6,005	2,013	10,095	635	526	5,164	314	19	3,285	225	0
Delta	1,246	16,253	8,925	5,804	4,184	2,273	8,020	962	876	44,343	5,497	1,892
Luce	164	5,464	5,054	11,101	661	1,035	5,096	278	44	4,249	266	203
Mackinac	780	6,260	2,205	2,822	719	469	4,655	201	50	10,588	1,463	600
Menominee	484	14,288	5,911	2,605	1,521	951	5,207	525	1,493	39,510	1,112	700
Schoolcraft	716	5,650	4,237	11,251	2,799	1,033	3,210	432	91	10,571	1,361	1,014
Total	4,107	57,076	32,552	47,913	14,527	7,442	33,618	3,045	2,726	116,345	10,427	4,606
W. UPPER PENINSULA												
Baraga	621	2,742	3,491	1,119	921	824	1,473	302	439	9,468	0	3,003
Dickinson	170	6,369	1,417	457	440	298	2,443	279	940	34,048	214	302
Gogebic	354	3,794	3,705	582	1,142	636	2,535	266	383	12,461	0	399
Houghton	297	2,802	2,414	1,826	1,742	795	999	223	224	7,541	0	204
Iron	465	14,058	3,620	5,075	3,277	1,063	6,892	558	1,408	53,879	105	407
Keweenaw	0	167	297	0	0	0	207	0	5	0	0	0
Marquette	1,242	14,808	9,574	18,813	9,023	3,892	7,222	920	402	42,258	2,388	3,432
Ontonagon	46	1,631	1,084	176	790	98	821	165	2,415	49,039	0	282
Total	3,195	46,371	25,602	28,048	17,335	7,606	22,592	2,713	6,216	208,694	2,707	8,029
N. LOWER PENINSULA						0						
Alcona	0	27	0	2,287	486	0	130	0	624	36,343	1,768	104
Alpena	0	655	0	2,117	0	0	608	0	1,248	23,132	1,144	104
Antrim	0	0	0	0	112	0	0	0	104	6,896	0	104
Arenac	0	0	0	0	0	0	0	0	0	728	0	0
Benzie	0	0	0	0	20	0	0	0	387	5,189	0	237
Charlevoix	0	536	0	26	0	0	28	0	0	3,276	0	0
Cheboygan	0	1,253	0	2,886	908	0	116	0	208	24,734	208	1,294
Clare	0	0	0	0	0	0	0	0	289	18,367	0	104
Crawford	0	131	0	10,196	0	0	55	0	104	9,445	0	260
Emmet	0	0	0	76	1,121	0	0	0	0	9,063	0	56
Gladwin	0	0	0	0	37	0	0	0	31	4,602	0	12
Grand Traverse	0	0	0	243	1,121	283	0	0	208	3,100	0	208
Iosco	0	20	0	5,445	2,719	0	0	0	210	4,569	104	0
Isabella	0	0	0	0	677	0	0	0	866	11,089	0	0
Kalkaska	0	0	0	2,478	1,063	0	0	0	0	2,417	0	0
Lake	0	0	0	14,000	3,000	1,199	0	0	587	10,964	0	520
Leelanau	0	0	0	0	287	0	0	0	21	44	0	21
Manistee	0	0	0	0	770	0	0	0	320	9,959	0	321
Mason	0	0	0	0	2,051	0	0	0	196	9,597	0	193
Mecosta	0	0	0	0	1,000	99	0	0	72	6,143	0	0
Midland	0	0	0	0	0	0	0	0	104	3,682	0	25
Missaukee	0	376	0	38	473	0	18	0	197	13,854	0	0
Montmorency	0	248	0	6,042	874	0	35	0	416	13,843	520	104
Newaygo	0	0	0	0	8,332	0	0	0	157	10,014	0	0
Oceana	0	0	0	0	4,607	0	0	0	75	5,100	0	54
Ogemaw	0	44	0	159	690	0	0	0	4	9,974	104	52
Osceola	0	0	0	3,003	426	0	0	0	28	12,324	0	21
Oscoda	0	92	0	8,531	360	0	26	0	320	26,579	624	104
Otsego	0	25	0	9,615	2,805	0	0	0	0	28,031	0	0
Presque Isle	0	2,410	49	1,982	0	0	438	0	832	23,423	1,040	208
Roscommon	0	0	0	5,015	467	0	0	0	3	16,744	0	48
Wexford	0	0	0	6,375	7,491	0	0	0	521	10,340	0	520
Total	0	5,817	49	80,514	41,897	1,581	1,454	0	8,132	373,565	5,512	4,674
S. LOWER PENINSULA												
Allegan	0	0	0	149	400	0	0	0	0	883	0	0
Barry	0	0	0	0	309	0	0	0	5	515	0	0
Berrien	0	0	0	149	6	0	0	0	0	0	0	0
Cass	0	0	0	0	80	0	0	0	0	0	0	0
Ingham	0	0	0	0	533	0	0	0	0	0	0	0
Kalamazoo	0	0	0	0	131	0	0	0	0	36	0	0
Kent	0	0	0	0	274	123	0	0	0	806	0	0
Montcalm	0	0	0	476	1,096	0	0	0	172	3,121	0	0
Muskegon	0	0	0	0	4,833	0	0	0	6	771	0	0
Ottawa	0	0	0	1,001	9,736	532	0	0	0	232	0	0
Van Buren	0	0	0	0	420	0	0	0	0	0	0	0
Washtenaw	0	0	0	0	300	82	0	0	0	0	0	0
Total	0	0	0	1,775	18,118	737	0	0	183	6,364	0	0
State total	7,302	109,264	58,203	158,250	91,877	17,366	57,664	5,758	17,257	704,968	18,646	17,309

(Table 9 continued on next page)

able 9 continued)

MICHIGAN

it and unty[1/]	Beech	White birch	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Other hard-woods	All species
UPPER PENINSULA												
Alger	2,513	898	1,002	0	1,183	0	6,095	2,823	239	1	673	39,883
Chippewa	365	356	209	0	195	0	917	518	70	0	196	31,380
Delta	5,180	10,410	2,295	0	3,893	0	14,813	9,389	860	7	2,834	149,956
Luce	701	605	405	0	368	0	1,887	1,059	126	20	188	38,974
Mackinac	1,431	2,183	441	0	774	0	4,023	2,522	360	2	517	43,065
Menominee	1,755	6,479	947	0	2,579	0	10,585	11,636	792	172	308	109,560
Schoolcraft	1,808	2,025	331	0	1,164	0	4,795	3,195	196	16	407	56,302
Total	13,753	22,956	5,630	0	10,156	0	43,115	31,142	2,643	218	5,123	469,120
UPPER PENINSULA				0								
Baraga	0	4,074	3,818	0	5,354	0	16,485	6,874	490	1	1,914	63,413
Dickinson	0	2,615	946	0	1,557	0	4,001	2,083	476	8	1,013	60,076
Gogebic	0	357	2,035	0	5,570	0	8,202	1,577	177	0	477	44,652
Houghton	0	1,645	1,897	0	2,216	0	5,487	2,387	178	20	655	33,552
Iron	0	5,097	6,566	0	6,682	0	18,952	7,049	686	95	1,584	137,518
Keweenaw	0	52	70	0	122	0	161	52	0	0	14	1,147
Marquette	0	5,988	1,459	0	3,430	0	13,098	6,348	1,375	120	2,190	147,982
Ontonagon	0	1,588	2,108	0	4,571	0	5,774	6,689	66	0	324	77,667
Total	0	21,416	18,899	0	29,502	0	72,160	33,059	3,448	244	8,171	566,007
LOWER PENINSULA						0						
Alcona	104	2,584	0	0	0	0	312	4,818	6,605	832	0	57,024
Alpena	208	1,904	0	0	0	0	728	6,797	4,354	624	0	43,623
Antrim	104	597	0	0	0	0	186	1,767	2,205	0	104	12,179
Arenac	0	0	0	0	0	0	104	312	0	0	0	1,144
Benzie	371	248	0	0	0	0	1,412	3,320	1,710	21	208	13,123
Charlevoix	0	209	0	0	0	0	0	943	70	0	0	5,088
Cheboygan	1,079	3,335	0	0	0	0	104	3,410	1,654	0	0	41,189
Clare	207	1,337	0	0	0	0	435	1,341	2,500	149	87	24,816
Crawford	104	1,004	0	0	0	0	156	2,026	1,562	57	52	25,152
Emmet	0	1,105	0	0	0	0	0	1,290	661	0	0	13,372
Gladwin	0	366	0	0	0	0	0	727	341	0	0	6,116
Grand Traverse	208	95	0	0	0	0	208	250	208	208	208	6,548
Iosco	104	496	0	0	0	0	211	1,550	1,676	225	0	17,329
Isabella	399	160	0	0	0	0	1,234	1,580	1,307	403	142	17,857
Kalkaska	0	280	0	0	0	0	0	118	101	0	0	6,457
Lake	322	340	0	0	0	0	608	9,320	11,170	572	108	52,710
Leelanau	21	0	0	0	0	0	30	21	21	21	42	529
Manistee	527	973	0	0	0	0	423	6,653	4,153	193	528	24,820
Mason	179	896	0	0	0	0	232	4,832	7,792	209	146	26,323
Mecosta	55	158	0	0	0	0	166	651	381	82	17	8,824
Midland	0	310	0	0	0	0	0	624	0	0	0	4,745
Missaukee	123	1,092	0	0	0	0	398	2,329	2,067	51	53	21,069
Montmorency	0	2,299	0	0	0	0	208	2,584	1,524	104	0	28,801
Newaygo	108	81	0	0	0	0	273	826	5,942	672	72	26,477
Oceana	49	152	0	0	0	0	80	2,542	4,428	347	63	17,497
Ogemaw	52	1,073	0	0	0	0	5	1,087	3,153	36	0	16,433
Osceola	25	325	0	0	0	0	64	2,242	5,769	251	22	24,500
Oscoda	104	2,577	0	0	0	0	115	4,562	5,482	604	0	50,080
Otsego	0	3,281	0	0	0	0	0	3,333	2,703	0	0	49,793
Presque Isle	104	4,937	0	0	0	0	208	4,219	446	0	0	40,296
Roscommon	0	1,547	0	0	0	0	4	1,127	835	26	0	25,816
Wexford	520	814	0	0	0	0	522	5,571	2,360	217	416	35,667
Total	5,077	34,575	0	0	0	0	8,426	82,772	83,180	5,904	2,268	745,397
LOWER PENINSULA												
Allegan	0	0	0	0	0	0	100	5	37	8	0	1,582
Barry	0	5	0	0	0	0	7	33	230	49	0	1,153
Berrien	0	0	0	0	0	0	0	0	0	0	0	155
Cass	0	0	0	0	0	0	0	0	0	0	0	80
Ingham	0	0	0	0	0	0	0	0	0	0	0	533
Kalamazoo	0	0	0	0	0	0	0	0	0	0	0	167
Kent	0	0	0	0	0	0	0	0	543	0	0	1,746
Montcalm	56	4	0	0	0	0	137	327	1,556	268	63	7,276
Muskegon	0	6	0	0	0	0	8	39	3,699	58	0	9,420
Ottawa	0	0	0	0	0	0	0	0	446	0	0	11,947
Van Buren	0	0	0	0	0	0	0	0	0	0	0	420
Washtenaw	0	0	0	0	0	0	0	0	0	0	0	382
Total	56	15	0	0	0	0	252	404	6,511	383	63	34,861
tate total	18,886	78,962	24,529	0	39,658	0	123,953	147,377	95,782	6,749	15,625	1,815,385

(Table 9 continued on next page)

(Table 9 continued)

MINNESOTA

Unit and county[1/]	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tamarack	Ash	Aspen	Balsam poplar	Basswood
ASPEN-BIRCH												
Carlton	0	932	0	416	364	48	2,101	194	0	11,704	2,080	0
Cook	0	21,940	0	4,721	2	0	14,910	0	0	17,083	52	0
Koochiching	0	22,761	0	9,546	1,064	313	64,378	17,865	104	94,601	12,121	0
Lake	0	5,790	0	12,038	466	1,144	18,436	69	0	28,141	624	0
St. Louis	0	21,459	0	26,845	6,199	2,458	26,707	3,707	42	161,585	14,995	0
Total	0	72,882	0	53,566	8,095	3,963	126,532	21,835	146	313,114	29,872	0
NORTHERN PINE												
Aitkin	0	809	0	281	21	9	1,351	2,488	0	37,613	1,768	0
Becker	0	59	0	1,090	156	88	0	42	0	894	33	0
Beltrami	0	10,192	0	11,070	2,202	330	11,856	6,131	94	44,423	2,137	19
Cass	0	864	0	8,872	1,777	493	532	1,369	50	49,102	662	0
Clearwater	0	1,523	0	2,870	378	106	2,098	2,766	0	19,271	478	18
Crow Wing	0	75	0	4,902	1,049	31	314	0	0	4,732	206	0
Hubbard	0	783	0	5,003	1,396	177	551	707	0	33,376	2,337	19
Itasca	0	23,455	0	8,261	1,564	621	10,848	2,342	62	153,655	6,353	0
Lake of the Woods	0	272	0	6,363	260	139	12,276	1,504	0	9,969	1,098	0
Mahnomen	0	0	0	208	87	0	0	0	0	1,105	104	0
Roseau	0	52	0	3,269	312	264	3,018	275	0	1,347	136	0
Wadena	0	11	0	9,347	2,435	290	14	0	0	1,585	250	0
Total	0	38,095	0	61,536	11,637	2,548	42,858	17,624	206	357,072	15,562	56
CENTRAL HARDWOOD		0										
Chisago	0	0	0	193	103	0	0	0	0	0	0	0
Goodhue	0	0	0	0	15	11	0	0	0	0	0	0
Hennepin	0	0	0	0	0	0	0	0	0	0	0	0
Isanti	0	0	0	1,172	777	0	0	0	0	0	0	0
Kanabec	0	0	0	0	0	0	0	0	0	3,387	284	0
Mille Lacs	0	0	0	104	24	0	62	177	0	8,745	0	8
Morrison	0	0	0	219	86	0	0	0	0	5,292	0	0
Otter Tail	0	0	0	0	0	0	0	0	0	130	10	0
Pine	0	0	0	343	218	50	199	11	0	11,291	711	0
Ramsey	0	0	0	0	0	0	0	0	0	0	0	0
Sherburne	0	0	0	2,589	1,857	49	0	0	0	0	0	0
Todd	0	0	0	1,087	153	0	0	0	0	104	36	0
Total	0	0	0	5,707	3,233	110	261	188	0	28,949	1,041	8
PRAIRIE												
Polk	0	0	0	0	0	0	219	2,883	0	253	16	0
Total	0	0	0	0	0	0	219	2,883	0	253	16	0
State total	0	110,977	0	120,809	22,965	6,621	169,870	42,530	352	699,388	46,491	64

Unit and county[1/]	Beech	White birch	Yellow birch	Cottonwood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Other hardwoods	All species
ASPEN-BIRCH												
Carlton	0	159	0	0	0	0	0	0	0	0	0	17,998
Cook	0	0	0	0	0	0	0	0	0	0	0	58,708
Koochiching	0	960	0	0	0	0	276	104	0	0	0	224,093
Lake	0	3,853	0	0	0	0	0	0	0	0	0	70,561
St. Louis	0	5,907	0	0	0	0	62	0	0	0	0	269,966
Total	0	10,879	0	0	0	0	338	104	0	0	0	641,326
NORTHERN PINE												
Aitkin	0	102	0	0	0	0	0	0	0	0	0	44,442
Becker	0	0	0	0	0	0	0	0	0	0	0	2,362
Beltrami	0	367	0	0	1	0	211	0	2	4	0	89,039
Cass	0	2,910	0	0	37	0	15	17	0	0	0	66,700
Clearwater	0	166	0	0	0	0	104	0	0	0	0	29,778
Crow Wing	0	156	0	0	0	0	0	0	0	0	0	11,465
Hubbard	0	55	0	0	0	0	0	0	0	0	0	44,404
Itasca	0	456	0	0	0	0	208	51	0	0	0	207,876
Lake of the Woods	0	0	0	0	0	0	0	0	0	0	0	31,881
Mahnomen	0	0	0	0	0	0	0	0	0	0	0	1,504
Roseau	0	0	0	0	0	0	0	0	0	0	0	8,673
Wadena	0	0	0	0	0	0	0	0	0	0	0	13,932
Total	0	4,212	0	0	38	0	538	68	2	4	0	552,056
CENTRAL HARDWOOD												
Chisago	0	0	0	0	0	0	0	0	0	0	0	296
Goodhue	0	0	0	0	0	0	0	0	0	0	0	26
Hennepin	0	0	0	0	78	0	0	0	0	0	0	78
Isanti	0	0	0	0	0	0	0	0	0	0	0	1,949
Kanabec	0	46	0	0	0	0	0	0	0	0	0	3,717
Mille Lacs	0	0	0	0	0	0	0	0	0	0	0	9,120
Morrison	0	0	0	0	0	0	0	0	0	0	0	5,597
Otter Tail	0	0	0	0	0	0	0	0	0	0	0	140
Pine	0	108	0	0	0	0	0	0	0	0	0	12,931
Ramsey	0	0	0	0	134	0	0	0	0	0	0	134
Sherburne	0	0	0	0	0	0	0	0	0	0	0	4,495
Todd	0	0	0	0	0	0	0	0	0	0	0	1,380
Total	0	154	0	0	212	0	0	0	0	0	0	39,863
PRAIRIE												
Polk	0	0	0	0	0	0	0	0	0	0	0	3,371
Total	0	0	0	0	0	0	0	0	0	0	0	3,371
State total	0	15,245	0	0	250	0	876	172	2	4	0	1,236,616

(Table 9 continued on next page)

(Table 9 continued) WISCONSIN

Unit and county[1/]	Cedar	Balsam fir	Hemlock	Jack pine	Red pine	White pine	Spruce	Tamarack	Ash	Aspen	Balsam poplar	Basswood
NORTHEASTERN												
Florence	0	3,011	724	1,010	1,162	74	1,999	57	520	36,016	0	89
Forest	0	18,943	2,286	808	5,175	78	7,326	229	4,061	59,621	0	2,248
Langlade	0	4,613	291	366	2,460	0	2,115	331	2,260	40,487	0	1,288
Lincoln	24	3,152	611	1,099	2,391	192	878	156	2,580	36,198	0	3,950
Marinette	0	7,472	2,071	18,462	11,213	485	5,849	261	1,921	114,586	0	107
Menominee	0	49	14,925	816	802	1,218	0	0	287	16,672	0	0
Oconto	0	1,344	471	10,570	5,946	44	1,470	335	534	30,341	0	61
Oneida	0	18,403	3,135	5,268	9,272	1,251	5,656	314	2,433	68,459	0	2,031
Shawano	0	169	580	1,179	4,209	23	0	27	267	17,677	0	10
Vilas	10	8,175	768	3,494	4,356	1,376	2,202	99	794	38,928	0	1,100
Total	34	65,331	25,862	43,072	46,986	4,741	27,495	1,809	15,657	458,985	0	10,884
NORTHWESTERN												
Ashland	3	12,960	469	1,579	2,143	424	1,375	109	2,062	40,585	0	194
Barron	0	0	0	250	215	0	0	0	17	836	0	0
Bayfield	0	2,428	196	14,459	2,997	723	240	15	507	53,799	0	2
Burnett	0	22	0	16,344	2,668	147	0	0	19	20,118	0	0
Douglas	0	365	0	37,486	5,086	0	66	82	99	49,263	0	0
Iron	0	2,800	566	401	609	533	418	70	1,845	17,610	0	804
Polk	0	0	0	505	80	12	0	0	2	618	0	0
Price	53	6,233	2,206	812	1,726	306	883	690	7,116	35,072	0	3,053
Rusk	0	195	468	134	174	0	0	81	2,186	18,405	0	1,127
Sawyer	0	6,580	1,167	1,578	1,580	220	464	7	2,932	41,692	0	1,357
Taylor	0	2,987	1,112	535	890	23	636	193	3,296	27,060	0	1,818
Washburn	0	483	0	7,964	10,275	354	241	0	247	21,217	0	0
Total	56	35,053	6,184	82,047	28,443	2,742	4,323	1,247	20,328	326,275	0	8,355
CENTRAL												
Adams	0	2	0	25,060	10,148	1,224	12	106	118	521	0	0
Chippewa	0	78	185	798	2,986	27	10	0	932	11,132	0	513
Clark	0	25	636	2,303	2,635	105	0	26	1,050	18,516	0	24
Eau Claire	0	0	0	3,231	2,153	55	5	0	218	2,735	0	14
Jackson	0	0	0	12,541	4,766	462	14	106	159	3,405	0	0
Juneau	0	0	0	9,132	6,931	2,326	0	0	164	1,902	0	0
Marathon	0	922	1,101	1,468	4,032	402	208	16	321	21,080	0	97
Marquette	0	0	0	1,596	1,849	192	0	2	39	108	0	0
Monroe	0	0	0	8,058	3,308	520	0	60	121	362	0	0
Portage	0	46	147	4,931	4,560	1,489	29	70	120	3,674	0	24
Waupaca	0	24	12	1,106	3,183	86	0	0	148	7,065	0	20
Waushara	0	0	0	2,568	8,981	952	0	0	29	89	0	0
Wood	0	0	45	6,467	5,040	1,680	306	0	501	14,167	0	0
Total	0	1,097	2,126	79,259	60,572	9,520	584	386	3,920	84,756	0	692
SOUTHWESTERN												
Buffalo	0	0	0	126	625	69	0	0	0	480	0	0
Crawford	0	0	0	0	0	0	0	0	47	220	0	87
Dunn	0	0	0	2,911	7,829	392	0	0	9	21	0	0
Grant	0	0	0	0	30	0	0	0	45	209	0	86
Iowa	0	0	0	0	23	5	0	0	0	14	0	0
Lacrosse	0	0	0	39	890	25	0	0	0	0	0	0
Pepin	0	0	0	610	1,059	177	55	0	3	75	0	0
Pierce	0	0	0	61	230	48	22	0	1	22	0	0
Richland	0	0	0	0	9	0	0	0	0	0	0	0
St. Croix	0	0	0	0	0	0	0	0	0	94	0	0
Sauk	0	0	0	1,417	2,803	441	0	0	31	0	0	0
Trempealeau	0	0	0	229	1,990	193	0	0	2	37	0	0
Vernon	0	0	0	0	85	12	0	0	1	0	0	0
Total	0	0	0	5,393	15,573	1,362	77	0	139	1,172	0	173
SOUTHEASTERN												
Brown	0	0	0	27	522	0	0	0	0	540	0	0
Columbia	0	0	0	518	3,989	114	0	0	111	68	0	0
Dane	0	0	0	0	46	23	0	0	0	0	0	0
Door	0	0	0	0	20	0	0	0	0	0	0	0
Green	0	0	0	21	274	0	0	0	0	0	0	0
Green Lake	0	0	0	14	625	48	0	0	28	0	0	0
Outagamie	0	0	0	0	226	47	17	0	0	1,352	0	0
Waukesha	0	0	0	0	1,078	64	0	0	2	0	0	0
Winnebago	0	0	0	22	0	0	0	0	0	0	0	0
Total	0	0	0	602	6,780	296	17	0	141	1,960	0	0
State total	90	101,481	34,172	210,373	158,354	18,661	32,496	3,442	40,185	873,148	0	20,104

(Table 9 continued on next page)

(Table 9 continued)

WISCONSIN

Unit and county[1/]	Beech	White birch	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Other hard-woods	All species
NORTHEASTERN												
Florence	0	4,321	1,164	0	2,500	0	4,733	1,577	719	164	56	59,896
Forest	1	10,268	1,961	0	4,046	0	13,615	4,136	658	122	631	136,213
Langlade	0	5,084	1,491	0	4,441	79	14,230	4,199	769	42	857	85,403
Lincoln	0	4,985	1,304	0	13,602	0	15,292	2,443	1,364	0	239	90,460
Marinette	35	15,067	713	0	2,806	0	4,043	3,858	2,644	525	224	192,342
Menominee	0	137	175	0	2,453	197	1,790	2,394	196	58	199	42,368
Oconto	0	5,543	91	0	965	0	1,004	762	389	70	53	59,993
Oneida	0	20,818	2,037	0	2,106	0	10,431	4,801	4,077	208	454	161,154
Shawano	0	355	205	0	3,220	336	2,890	452	1,024	38	226	32,887
Vilas	0	14,082	1,118	0	543	0	5,518	1,480	1,956	243	66	86,308
Total	36	80,660	10,259	0	36,682	612	73,546	26,102	13,796	1,470	3,005	947,024
NORTHWESTERN												
Ashland	0	9,488	1,798	0	3,856	0	7,516	3,105	1,325	137	82	89,210
Barron	0	28	3	0	32	0	54	51	38	11	1	1,536
Bayfield	0	13,971	187	0	677	0	1,017	455	612	12	8	92,305
Burnett	0	335	0	0	55	0	208	92	50	16	0	40,074
Douglas	0	3,549	6	0	96	0	201	154	72	24	1	96,550
Iron	0	4,062	1,015	0	12,521	0	13,485	1,391	828	122	69	59,149
Polk	0	3	0	0	11	0	13	8	4	2	0	1,258
Price	0	14,155	3,584	0	17,911	0	17,380	7,050	3,879	860	232	123,201
Rusk	0	5,579	1,065	0	2,358	0	5,490	2,683	1,786	372	133	42,236
Sawyer	0	9,580	1,458	0	2,862	0	10,087	2,588	1,294	244	385	86,075
Taylor	0	5,662	1,746	0	11,337	0	12,778	3,406	1,601	389	275	75,744
Washburn	0	2,030	173	0	257	0	1,164	447	218	53	16	45,139
Total	0	68,442	11,035	0	51,973	0	69,393	21,430	11,707	2,242	1,202	752,477
CENTRAL												
Adams	0	229	3	0	509	0	228	416	5,223	2,276	2	46,077
Chippewa	0	2,741	801	0	1,309	0	1,522	1,313	1,808	880	28	27,063
Clark	2	2,886	503	0	1,949	0	1,597	1,362	6,054	2,519	53	42,245
Eau Claire	1	488	72	0	495	0	389	561	1,270	324	45	12,056
Jackson	2	724	161	0	376	0	219	521	4,028	1,440	36	28,960
Juneau	0	1,026	17	0	597	0	490	937	4,437	2,323	11	30,293
Marathon	0	1,743	335	0	2,954	10	3,020	969	1,347	431	15	40,471
Marquette	0	386	0	0	538	0	179	607	1,686	1,282	0	8,464
Monroe	0	194	3	0	246	0	278	322	1,041	361	1	14,875
Portage	0	315	45	0	428	0	461	369	1,584	1,621	12	19,925
Waupaca	0	126	39	0	305	14	214	311	807	244	20	13,724
Waushara	0	51	1	0	79	0	111	129	301	71	1	13,363
Wood	0	1,316	130	0	928	0	475	501	3,928	1,577	8	37,069
Total	5	12,225	2,110	0	10,713	24	9,183	8,318	33,514	15,349	232	334,585
SOUTHWESTERN												
Buffalo	0	0	0	0	0	0	0	0	0	0	0	1,300
Crawford	0	71	0	16	164	0	83	105	618	234	21	1,666
Dunn	0	9	3	0	101	0	86	12	2	0	3	11,378
Grant	0	70	0	14	161	0	84	96	637	240	21	1,693
Iowa	0	0	0	0	0	0	0	0	0	0	0	42
Lacrosse	0	0	0	0	0	0	0	0	0	0	0	954
Pepin	0	125	0	0	16	0	11	8	9	3	2	2,153
Pierce	0	1	0	0	9	0	7	2	0	0	0	403
Richland	0	0	0	0	0	0	0	0	0	0	0	9
St. Croix	0	0	0	0	0	0	0	0	0	0	0	94
Sauk	0	57	0	0	89	0	133	148	80	27	0	5,226
Trempealeau	0	3	0	0	6	0	3	3	0	0	1	2,467
Vernon	0	1	0	0	2	0	1	1	0	0	0	103
Total	0	337	3	30	548	0	408	375	1,346	504	48	27,488
SOUTHEASTERN												
Brown	0	5	0	0	0	0	0	6	0	0	0	1,100
Columbia	9	381	3	0	194	0	256	144	372	214	35	6,408
Dane	0	0	0	0	0	0	0	0	0	0	0	69
Door	0	0	0	0	0	0	0	0	0	0	0	20
Green	0	0	0	0	0	0	0	0	0	0	0	295
Green Lake	7	7	2	0	53	0	27	17	0	0	17	845
Outagamie	0	0	0	0	0	0	0	16	0	0	0	1,658
Waukesha	0	3	0	0	5	0	7	8	4	2	0	1,173
Winnebago	0	0	0	0	0	0	0	0	0	0	0	22
Total	16	396	5	0	252	0	290	191	376	216	52	11,590
State total	57	162,060	23,412	30	100,168	636	152,820	56,416	60,739	19,781	4,539	2,073,164

[1/] Includes only those counties that supplied pulpwood in 1980.

Table 10.--Central States pulpwood production by State and destination, 1976-1980.

(In thousand standard cords, unpeeled)

Year	Illinois			Indiana			Iowa			Missouri		
		Destination			Destination			Destination			Destination	
	Total	Central States	Other States	Total	Central States	Other States	Total	Central States	Other States	Total	Central States	Other States
1976	116	65	51	172	78	94	45	41	4	132	55	77
1977	111	53	58	161	66	95	50	46	4	123	44	79
1978	100	49	51	190	81	109	42	40	2	99	42	57
1979	102	52	50	204	89	115	69	56	13	101	42	59
1980	102	45	57	178	69	109	44	39	5	105	38	67

Table 11.--Trends in receipts of roundwood and residue as pulpwood, Central States, 1976-1980

(In thousand standard cords, unpeeled)

Type of material and Area	1976	1977	1978	1979	1980
ROUNDWOOD					
Illinois	18	24	30	33	19
Indiana, Iowa, Missouri	81	62	70	96	75
Total	99	86	100	129	94
RESIDUE					
Illinois	71	62	54	59	28
Indiana, Iowa, Missouri	102	98	95	107	99
Total	173	160	149	166	127
All material	272	246	249	295	221

Blyth, James E.; Smith, W. Brad
Pulpwood production in the North Central Region, by County, 1980. Resour. Bull. NC-59, St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1982. 21 p.

Discusses 1980 production and receipts and recent production for other years in the Lake and Central States. Shows Michigan, Minnesota, and Wisconsin production by species for each county and compares production by Forest Inventory Unit with that of previous years. Presents 1980 production and receipt data for Illinois, Indiana, Iowa, and Missouri, and shows four production classes by county.

KEY WORDS: Roundwood, residue, receipts, Lake States, Central States.

☆U. S. GOVERNMENT PRINTING OFFICE: 1983—665-659/196

United States Department of Agriculture

Forest Service

North Central Forest Experiment Station

Resource Bulletin **NC-60**

Timber Resource of Michigan's Western Upper Peninsula, 1980

John S. Spencer, Jr.

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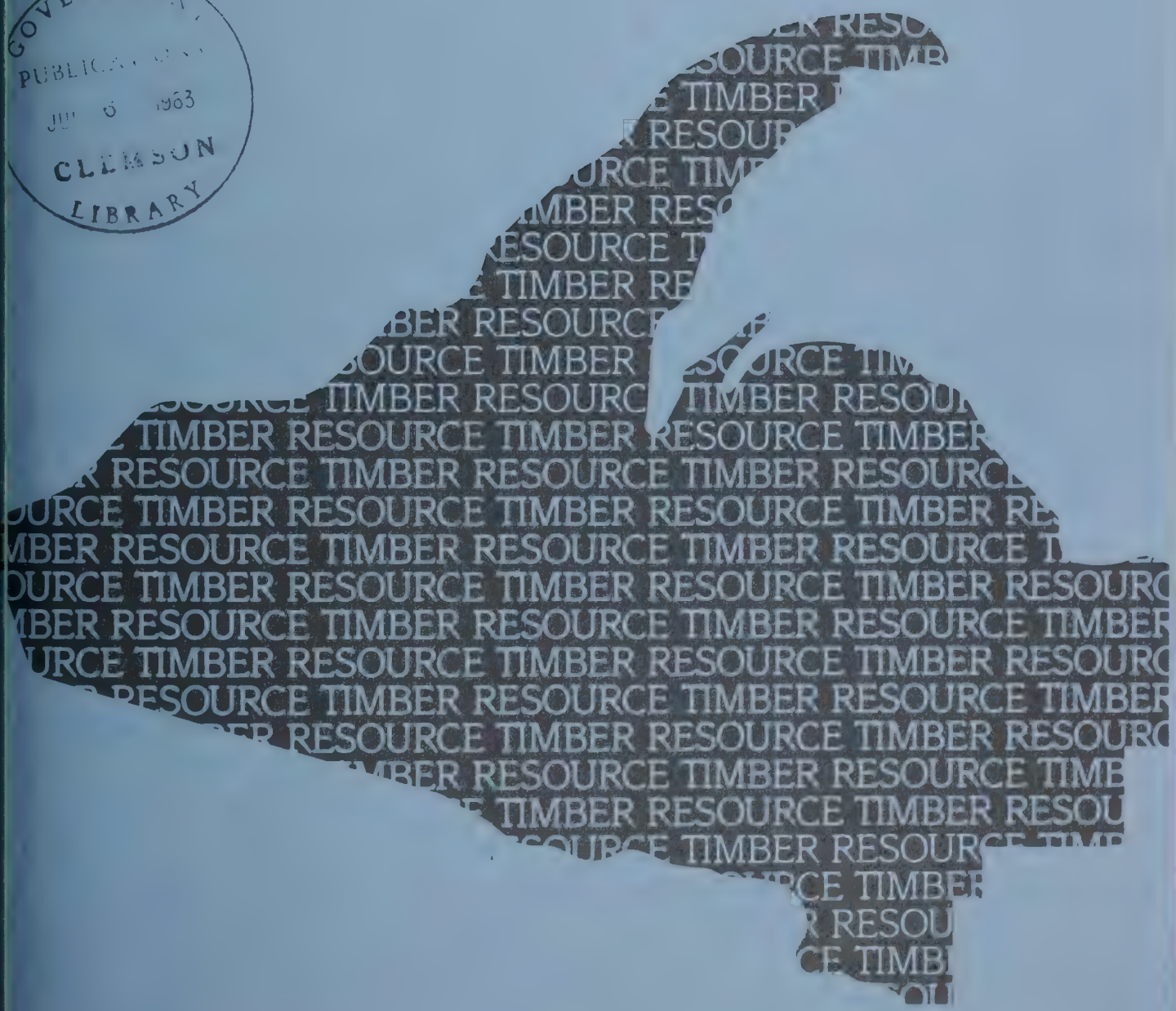
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Information contained in this report includes the most commonly used Resources Evaluation statistics. However, additional forest resource data can be provided to interested users. Persons requesting additional information that can be provided from the raw inventory data are expected to pay for the retrieval costs. These costs will vary depending on the complexity of the request, from less than $100 for a relatively simple request to $2,000 for a complex retrieval involving the services of a Resources Evaluation computer programmer. If requests for data conflict with ongoing Resources Evaluation work, requests will be scheduled so as to minimize the impact on the work unit.

Requests for unpublished information may be directed to:

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Manuscript approved for publication October 28, 1981
1982

FOREWORD

Resources Evaluation (formerly called Forest Survey) is a continuing endeavor as mandated by the Forest and Rangeland Renewable Resources Planning Act of 1974, which was preceded by the McSweeney-McNary Forest Research Act of 1928. Its objective is to periodically inventory the Nation's forest land to determine its extent, condition, and volume of timber, growth, and depletions. This kind of up-to-date information is essential to frame intelligent forest policies and programs. USDA Forest Service regional experiment stations are responsible for conducting these inventories and publishing summary reports for individual States. The North Central Forest Experiment Station is responsible for Resources Evaluation work done in Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, eastern South Dakota, and Wisconsin.

Fieldwork for the 1980 Western Upper Peninsula forest inventory was begun in October 1977 and was completed in December 1979. Reports on the three previous surveys of Michigan's timber resource are dated 1935, 1955, and 1966.

Similar Resource Bulletins reporting statistical highlights and detailed tables on the other Survey Units in Michigan (see cover) are or soon will be available. In addition to these statistical reports, a series of reports will be published that will analyze the State's timber resource.

More accurate survey information was obtained during the 1980 survey than otherwise would have been feasible because of intensified field sampling. Such sampling was made possible by additional funding and manpower provided the North Central Station through the Michigan Department of Natural Resources and by interested forest industry members. Data from the Department's canvass of all primary wood-using plants in the State were used to help estimate the quantity of timber products harvested in Michigan.

Aerial photos used in the Western Upper Peninsula Forest Inventory were furnished by the Michigan Department of Natural Resources and the Ottawa National Forest.

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TIMBER RESOURCE OF MICHIGAN'S WESTERN UPPER PENINSULA UNIT, 1980

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HIGHLIGHTS

Forest Area

Forest land accounted for 4.9 million acres (88 percent of the Unit's land area) in 1980, compared to 5.2 million acres (93 percent) in 1966.

Commercial forest land occupied 4.5 million acres (93 percent of the forest land) in 1980, compared to 4.9 million acres (95 percent) in 1966—an 8-percent decline.

- Productive-reserved forest land totaled 267 thousand acres in 1980, compared to 185 thousand acres in 1966. Additions since 1966 include the Sturgeon River and Sylvania RARE II areas and the McCormick and Sylvania tracts on the Ottawa National Forest, as well as State sharptail grouse management areas and waterfowl project areas.
- Marquette County contained the largest area of commercial forest in 1980 (970 thousand acres) as it did in 1966 (1,097 thousand acres).
- Nonindustrial private parties owned 1.7 million acres (38 percent of the commercial forest) in 1980, compared to 2.0 million acres (40 percent) in 1966.
- The maple-birch forest type continues to dominate the commercial forest, representing 52 percent of the total in 1980, compared to 45 percent in 1966.
- Forty-five percent of the privately owned commercial forest has been owned by its present owner 20 years or more.
- Poletimber stands occupied 46 percent of the commercial forest in 1980 as compared to 44 percent in 1966, although the area of this stand-size class declined slightly between surveys.
- Sawtimber stands—the area of which increased by 88 thousand acres between surveys—amounted to 36 percent of the commercial forest in 1980, compared to 32 percent in 1966.

Timber Volume

- The volume of growing stock in 1980 was 5.8 billion cubic feet, 22 percent greater than the 4.8 billion[1] in 1966, in spite of the 8-percent loss of commercial forest land between surveys.
- Sawtimber volume amounted to 15.2 billion board feet[2] in 1980.
- Hardwoods make up 70 percent of the growing-stock volume.
- Hard maple (1,405 million cubic feet), quaking aspen (643 million), and soft maple (629 million) contain the highest volumes, and together account for nearly half of the growing-stock volume.
- Twenty-two percent of the 8-county Survey Unit's growing-stock volume is in Marquette County.
- Average growing-stock volume per acre in 1980 was 1,277 cubic feet (16.2 cords), compared to 967 cubic feet (12.2 cords) in 1966.
- Thirty-two percent of the growing-stock volume is in stands aged 41 to 60 years.
- Two-thirds of the sawtimber volume is in grade 3 saw logs.
- The volume in cull trees (rough, rotten, and short-log cull) is 565 million cubic feet; salvable dead tree volume is 198 million cubic feet.

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[1]*Published 1966 volumes were adjusted by factors derived from 1980 volume equations to make volumes for the two inventories comparable.*

[2]*International ¼-inch rule.*

Stand Conditions

- Net annual growth on growing-stock trees was 195 million cubic feet in 1979, compared to 139 million in 1965.
- The net annual growth rate of growing stock was 3.4 percent of inventory in 1979, compared to 2.9 percent in 1965.
- Net growth averaged 43.0 cubic feet per acre in 1979—28.2 cubic feet per acre in 1965.
- Annual mortality of growing stock amounted to 48 million cubic feet (0.8 percent of inventory) in 1979, compared to 37 million (0.8 percent of inventory) in 1965.
- Disease accounted for 47 percent of the mortality in 1979—chiefly diseases of aspen and elm.
- Insects caused only 5 percent of softwood mortality in 1979. However, this proportion will rise as the effects of the spruce budworm epidemic, which began after the current survey, are felt.
- Seventy-six percent of the commercial area can grow trees 51 feet and taller at age 50, and 23 percent of the area can grow trees 71 feet and taller at the same age.
- Stands aged 50 years or less declined from 62 percent of the commercial area in 1966 to 40 percent in 1980.

Timber Use

- Timber removals from growing stock in 19 amounted to 78 million cubic feet (1.4 percent inventory), compared to 68 million cubic feet (1 percent of inventory) in 1965.
- Marquette County accounted for 21 percent of tl 1979 removals, followed by Iron County (17 pe cent and Ontonagon County (14 percent).
- The aspens made up 34 percent of the 1979 r movals volume, although they account for only percent of the growing-stock volume.
- Output of timber products totaled 75 million cub feet in 1978, 61 percent of which was pulpwood
- Wood residue from primary plants totaled 8.1 mi lion cubic feet in 1978, of which 1.9 million we not used.

Biomass

- Live shrub biomass (including trees less than inch d.b.h.) was highest in the tamarack fores type—5,800 pounds per acre (green weight) in 198
- Live tree biomass (trees greater than 1 inch d.b.h totaled 319 million green tons (an average of 7 tons per acre) in 1980.
- Highest yields of live tree biomass (green weight are in the oak-hickory forest type (89 tons pe acre), the white pine type (84 tons), the maple birch type (83 tons), and the paper birch type (7 tons).

APPENDIX

ACCURACY OF SURVEY

Resources Evaluation information is based on a mpling procedure designed to provide reliable sta-istics at the State and Survey Unit levels. Conse-uently, the reported figures are estimates only. A easure of reliability of these figures is given by mpling errors. These sampling errors mean that e chances are two out of three that if a 100-percent ventory had been taken, using the same methods, e results would have been within the limits indi-ted.

For example, the estimated growing-stock volume the Western Upper Peninsula Unit in 1980, 5,785.0 illion cubic feet, has a sampling error of ± 0.99 rcent (± 57,271 thousand cubic feet). The grow-g-stock volume from a 100-percent inventory, then, uld be expected to fall between 5,842.3 and 5,727.7 illion cubic feet (5,785.0 ± 57.3), there being a one three chance that this is not the case.

Sampling errors were calculated separately for ational Forest land and other land because of the gher sampling intensity on other land. For ex-mple, the sampling error for growing-stock volume land other than National Forest is ± 1.02 percent ut for Ottawa National Forest land it is ± 2.81 rcent.

The following tabulation shows the combined mpling errors for the 1980 Western Upper Penin-la Forest Inventory:

Item	Unit totals (Million cubic feet)	Sampling error (Percent)
rowing stock		
Volume	5,785.0	0.99
Growth	194.7	1.48
Removals	78.3	13.00
awtimber	(Million board feet)	
Volume	15,246.2	1.61
Growth	701.4	3.07
Removals	243.8	15.80
ommercial forest land	(Thousand acres)	
Area	4,529.6	0.36

As survey data are broken down into sections maller than State or Survey Unit totals, the sam-ling error increases. The smaller the breakdown, the larger the sampling error. For example, the sampling error for growing-stock volume in a particular county is higher than that for total growing-stock volume in the Survey Unit (table 74 shows the sampling errors for estimates smaller than Unit totals).

SURVEY PROCEDURES

The major steps in the survey of the Western Upper Peninsula Unit were as follows:

1. A total of 22,458 1-acre points were systematically distributed across aerial photos of the entire Unit, except the Ottawa National Forest. These points were classified into land classes as shown below, to make a preliminary estimate of forest area. Next, a total of 19,077 of these points were stereoclassified as to forest type, stand-size class, and density. Finally, a total of 2,777 points were examined on the ground to correct the preliminary area estimate for errors in classification and for actual changes in land use since the photos were taken.

	Photo points		Ground plots visited
	Classified	Stereo-classified	
Forest land	18,899	18,899	2,339
Unproductive forest land	1	1	1
Nonforest land			
With trees	72	9	9
Without trees	2,600	0	325
Water	718	0	86
Questionable	168	168	17
Total	22,458	19,077	2,777

At each of the 2,296 commercial forest locations, variable-radius plots (basal area factor 37.5) were established at 10 points uniformly placed over the sample acre. Tree measurements made at these locations and at 179 plots established in 1966 and remeasured in 1980 were the basis for estimates of timber volume, growth, mortality, number of trees, and other forest classifications on land other than National Forest land. Estimates for National Forest land were based on 188 plots established in 1980 on commercial forest land on the Ottawa National Forest and on 3 plots remeasured in 1980 on commercial forest land on the Dukes Experimental Forest.

2. Growth and mortality on all commercial forest land were estimated using the Stand and Tree Evaluation and Modeling System (STEMS)[3] after the System was adjusted with factors derived from the remeasurement in 1979 of permanent sample plots in the Upper Peninsula that were established in 1965. STEMS is an individual tree-growth projection system that uses the following stand and tree characteristics to "grow" trees by updating tree diameter and tree status (live, dead, or cut): species, tree diameter, crown ratio, site index, basal area, and average stand diameter. These characteristics were used to produce growth and mortality rates that were adjusted based on ground conditions gained from remeasurement of plots and applied to trees on the tree list to yield an updated tree list. Local volume equations were applied to the original and updated tree lists to estimate volumes of growth and mortality.

3. Under an agreement with the Ottawa National Forest, North Central Station crews established 10-point variable radius plots on the Ottawa Forest at the same time they established other plots in the Western Upper Peninsula Survey Unit. The Ottawa National Forest provided the Station with the area of commercial forest land by forest type, stand-size class, and density for the Forest; and the Station computed all area and volume data in the same manner non-National Forest data were computed. Area and volume tables were approved by the Ottawa National Forest staff before publication.

4. Statistics on timber utilization during 1978 were obtained from mill surveys. The Michigan Department of Natural Resources canvassed resident sawmills, veneer mills, and other primary wood-using plants. The North Central Forest Experiment Station canvassed out-of-State sawmills, pulpmills, and veneer mills to determine their use of timber from Michigan. Fuelwood and fencepost output was based on a sample of public and private landowners to determine their production of fuelwood and fenceposts, and on a canvass of industrial and public timber owners. Estimates of primary mill residue used for fuelwood were obtained from the canvass of Michigan primary wood-using plants. Timber cut for products by ownership class was determined by a canvass of public and industrial timber owners. The portio of timber cut unaccounted for by the latter owne was grouped under "farmer and other owners."

5. A total of 2,239 felled trees on 123 active loggir operations were measured throughout the State du ing 1977-1978 to develop wood utilization factors f converting timber products output to timber remo als for saw logs and pulpwood. Factors for all oth products were obtained during the 1964-1965 Mic igan utilization study.

6. Field data were sent to St. Paul for compilatio

COMPARING MICHIGAN'S FOURTH INVENTORY WITH THE THIRD INVENTORY

Data from new forest inventories are often com pared with data from earlier inventories to dete mine trends in timber volumes. Changes in proc dures and definitions between surveys make i necessary to adjust earlier survey data so that the are comparable to data from the new survey. A cor sistency check was made for each Forest Survey Uni in Michigan to ensure that the changes observe between inventories reflect actual changes in th resource and not changes in definitions or proce dures.

In Michigan's Western Upper Peninsula Unit th only definitional or procedural change between th 1966 and 1980 inventories was in the volume equa tions used. The volume equations used in 1980 gav more accurate estimates of tree volume than thos used in 1966. Therefore, the 1966 volumes were ad justed by factors derived from the 1980 volume equa tions to make them comparable to 1980 volumes.

A test was then made to ensure that it was pos sible to move from the adjusted 1966 volumes to th 1980 volumes, by means of Timber Resource Anal ysis System (TRAS), a Forest Service computer pro gram for updating, backdating, and projecting tim ber volume, growth, mortality, and removals. Usin the 1966 numbers of softwood and hardwood tree by 2-inch diameter class and applying 1980 cubi feet per tree and board foot-cubic foot ratios yield estimates of 1966 softwood and hardwood volume that are comparable with 1980 volumes. Then, using growth rates, mortality rates, and removals rates for the period between the two surveys, TRAS moves the inventories through the period. The program prints out volumes by diameter class and softwoods and hardwoods for each year in the period. Thus,

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[3]*For more information on STEMS, see: Belcher, D. L.; Holdaway, M. R.; Brand, G. J. A description to STEMS: The stand and tree evaluation and modeling system. Gen. Tech. Rep. NC-79. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; (In prep.) p.*

onsistencies in volume, growth, mortality, and re-vals can be identified and resolved. A small down-rd adjustment in the 1966 softwood growth rate s necessary to move smoothly from 1966 to 1980 stern Upper Peninsula values.

TRAS generates an estimate of what total remov- had to be for the inventory to have changed as did between surveys, given the volume, growth, d mortality inputs. Estimates for removals for ducts and for logging residues—two of the three nponents of total timber removals—are available m an independent utilization study. An estimate "other" removals (see Definition of Terms in Ap-ndix), the third component of total removals, is ıde by subtracting the first two removals compo-nts from the TRAS-generated total removals es-nate. This estimate of "other" removals is com-red with findings from remeasurement plots and w plots (stump counts and land use change) to eck its validity. Total removals are "trend level novals" because the estimate of "other" removals based on a removals trend line from 1966 to 1980.

In 1966 State Forest was a separate owner class d included only land on State Forests. Other for-ted State-owned land was included under the Other blic owner class. In 1980 the State owner class cluded all State lands. Therefore, a comparison of atistics on State land between 1966 and 1980 is t possible.

Some mining companies were called diversified rest industry in 1966 and classed under Forest In-stry owner class. In 1980 these companies were classed under Miscellaneous Private Corporation owner class. Therefore, a comparison of statistics for Forest Industry owner between 1966 and 1980 is not possible.

LOG GRADE

In Michigan's Western Upper Peninsula the butt log of every sawtimber tree on every full permanent sample plot (5,374 trees) was graded for quality. Additionally, all of the logs in a smaller sample of trees throughout the State (2,239 trees) were graded. The volume yield by log grade for each tree in the latter sample was used to distribute the volume of trees in the former sample into log-grade classes. The resulting volumes by log-grade classes were expanded to provide an estimate for the entire Unit.

Logs were graded on the basis of external characteristics as indicators of quality. Hardwood species were graded according to "Hardwood Log Grades for Standard Lumber."[4] The best 12-foot section of the lowest 16-foot hardwood log, or the best 12-foot upper section if the butt log did not meet minimum log-grade standards, was graded as follows:

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[4]*Vaughn, C. L.; Wollin, A. C.; McDonald, K. A.; and Bulgrin, E. H. Hardwood log grades for standard lumber. Res. Pap. FPL-63. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory; 1966. 52 p.*

Forest Service standard grades for hardwood factory saw logs

Grading factors		Specifications							
		Log grade 1			Log grade 2				Log grade
Position in tree		Butts only	Butts and uppers		Butts and uppers				Butts and uppers
Scaling diameter, inches		[1]13-15	16-19	20+	[2]11+	12+			8+
Length without trim, feet			10+		10+	8-9	10-11	12+	8+
Required clear cuttings of each of three best faces[4]	Min. length, feet	7	5	3	3	3	3	3	2
	Max. number	2	2	2	2	2	2	3	No Limit
	Min. proportion of log length required in clear cutting	5/6	5/6	5/6	2/3	3/4	2/3	2/3	1/2
Maximum sweep and crook allowance	For logs with less than one-fourth of end in sound defects		15 percent			30 percent			50 percent
	For logs with more than one-fourth of end in sound defects		10 percent			20 percent			35 percent
Maximum scaling deduction			40 percent[5]			50 percent[6]			50 percent

[1]Ash and basswood butts can be 12 inches if they otherwise meet requirements for small #1's.
[2]Ten-inch logs of all species can be #2 if they otherwise meet requirements for small #1's.
[3]A clear cutting is a portion of a face, extending the width of the face, that is free of defects.
[4]A face is one-fourth of the surface of the log as divided lengthwise.
[5]Otherwise #1 logs with 41-60 percent deductions can be #2.
[6]Otherwise #2 logs with 51-60 percent deductions can be #3.

Forest Service standard specifications for hardwood construction logs (tie and timber logs)[1]

sition in tree		Butt and upper
n. diameter, small end		8 inches +
n. length, without trim		8 feet
ar cuttings		No requirements.
eep allowance, absolute		One-fourth of the diameter at the small end for each 8 feet of length.
und rface fects	Single knots	Any number, if no one knot has an average diameter above the callus in excess of one-third of log diameter at point of occurrence.
	Whorled knots	Any number if sum of knot diameters above the callus does not exceed one-third of log diameter at point of occurrence.
	Holes	Any number provided none has a diameter over one-third of log diameter at point of occurrence, and none extends over 3 inches into included timber.[2]
nsound surface defects		Same requirements as for sound defects if they extend into included timber.[2] No limit if they do not.
	Sound	No requirements.
id fects	Unsound	None allowed; log must be sound internally, but will admit one shake not to exceed one-fourth of the scaling diameter and will admit a longitudinal split not extending over 5 inches into the contained timber.

[1]These specifications are minimum for the class. If, from a group of logs, factory logs are selected first, thus leaving only nonfactory logs from nich to select construction logs, then the quality range of the construction logs so selected is limited, and the class may be considered a grade. selection for construction logs is given first priority, then it may be necessary to subdivide the class into grades.
[2]Included timber is always square, and dimension is judged from small end.

Softwood species were graded according to the following specifications on the following page.

Log Grades for Eastern White Pine

Log grade	Minimum size Diameter	Minimum size Length[1]	Sweep or crook allowance	Total cull allowance including sweep	Maximum weevil injury	Allowable knot size (inches)[2] on three best faces or minimum clearness on four faces
	Inches	*Feet*	—— *Percent* ——		*Number*	*Inches*
1	12 & 13	8-16	20	50	0	Four faces clear full length
	14+	10-16	20	50	0	Two faces clear full length, or four faces clear 50 percent length (6 feet min. length)[3]
2	6+	8-16	30	50	0	Sound knots 1.e.[4] D/6 and less than 3 inches.[5] Unsound knots: 1.e. 1½ inches and for: butt, lots 1.e. D/12, upper logs 1.e.D/10, or four faces clear 50 percent of length
3	6+	8-16	40	50	8-foot logs 1 weevil 10-foot+ logs: 2 weevils	Sound knots 1.e.D/3 and less than 5 inches. Unsound knots 1.e. D/6 and less than 2½ inches.
4	6+	8-16	50	50	No limit	No limit

[1]Plus trim.
[2]Disregard all knots less than ½-inch diameter in all grades.
[3]The sum of the diameter of sound knots plus twice the sum of the diameter of unsound knots (in inches) is less than or equal to ½ of the diameter of the log (inches).
[4]1.e. means less than or equal to.
[5]D means d.i.b. of log at location of knot.

Log Grades for Jack Pine and Red Pine

Grade 1: logs with three or four clear faces.[5]

Grade 2: logs with one or two clear faces.

Grade 3: logs with no clear faces.

After the tentative log grade is established, the log will be degraded one grade for each of the following, except that no log can be degraded below grade 3. Net scale after deduction for defect must b at least 50 percent of the gross contents of the log

1. *Sweep.* Degrade any tentative 1 or 2 log on grade if sweep amounts to 3 or more inches and equal or exceeds one-third the diameter inside bark at sma end.

2. *Heart rot.* Degrade any tentative 1 or 2 log grad if conk, massed hyphae, or other evidence of ad vanced heart rot is found anywhere in it.

[5]*A face is one-fourth of the circumference in width extending full length of the log. Clear faces are those free of: knots measuring more than ½-inch in diameter, overgrown knots of any size, holes more than ¼-inch in diameter. Faces may be rotated to obtain the maximum number of clear ones.*

Log Grades for All Other Softwood Logs

Grade 1

1. Logs must be 16 inches in diameter or larger, 1(feet or longer, and with deduction for defect no more than 30 percent of gross scale.

Logs must be at least 75 percent clear on each of three faces.
All knots outside clear cutting must be sound and not more than 2½ inches in size.

rade 2

Logs must be 12 inches in diameter or larger, 10 feet or longer, and with a net scale after deduction for defect of at least 50 percent of the gross contents of the log.
Logs must be at least 50 percent clear on each of three faces or 75 percent clear on two faces.

rade 3

Logs must be 6 inches in diameter or larger, 8 feet or longer, and with a net scale after deduction for defect of at least 50 percent of the gross contents of the log.

ote: (A) Diameters are diameter inside bark (d.i.b.) at small end of log.
(B) Percent clear refers to percent clear in one continuous section.

TREE SPECIES GROUPS IN MICHIGAN'S WESTERN UPPER PENINSULA UNIT[6]

SOFTWOODS
- Eastern white pine .... *Pinus strobus*
- Red pine ..... *Pinus resinosa*
- Jack pine ..... *Pinus banksiana*
- White spruce ..... *Picea glauca*
- Black spruce ..... *Picea mariana*
- Balsam fir ..... *Abies balsamea*
- Eastern hemlock ..... *Tsuga canadensis*
- Tamarack ..... *Larix laricina*
- Northern white-cedar .. *Thuja occidentalis*

OTHER SOFTWOODS
- Eastern redcedar ..... *Juniperus virginiana*
- Norway spruce ..... *Picea abies*

HARDWOODS
- White oaks
  - Bur oak ..... *Quercus macrocarpa*
- Select red oak
  - Northern red oak .... *Quercus rubra*
- Yellow birch ..... *Betula alleghaniensis*
- Hard maples
  - Sugar maple ..... *Acer saccharum*
  - Black maple ..... *Acer nigrum*
- Soft maples
  - Red maple ..... *Acer rubrum*
  - Silver maple ..... *Acer saccharinum*
- American beech ..... *Fagus grandifolia*
- Ashes
  - White ash ..... *Fraxinus americana*
  - Black ash ..... *Fraxinus nigra*
  - Green ash ..... *Fraxinus pennsylvanica*
- Balsam poplar ..... *Populus balsamifera*
- Eastern cottonwood .... *Populus deltoides*
- Aspens
  - Bigtooth aspen ..... *Populus grandidentata*
  - Quaking aspen ..... *Populus tremuloides*
- Basswood ..... *Tilia americana*
- Black cherry ..... *Prunus serotina*
- Elms
  - American elm ..... *Ulmus americana*
  - Slippery elm ..... *Ulmus rubra*
  - Rock elm ..... *Ulmus thomasii*
- Paper birch ..... *Betula papyrifera*

Other hardwoods
- Boxelder ..... *Acer negundo*
- River birch ..... *Betula nigra*
- Black willow ..... *Salix nigra*

METRIC EQUIVALENTS OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare.

1,000 acres = 405 hectares.

1,000 board feet (International ¼-inch log rule) = 3.48 cubic meters.

Breast height = 1.4 meters above the ground.

1 cubic foot = 0.0283 cubic meter.

1 foot = 30.48 centimeters or 0.3048 meter.

1 inch = 25.4 millimeters, 2.54 centimeters, or 0.0254 meter.

1 pound = 0.454 kilogram.

1 ton = 0.907 metric ton.

DEFINITION OF TERMS

Acceptable trees.—Growing-stock trees of commercial species that meet specified standards of size and quality but do not qualify as desirable trees.

[6]*The common and scientific names are based on: Little, Elbert L. Checklist of native and naturalized trees of the United States. Agric. Handb. 541. Washington, DC:U.S. Department of Agriculture, Forest Service; 1979. 375 p.*

Area-condition classes.—Class 10.—Areas fully stocked with desirable trees but not overstocked.

Class 20.—Areas fully stocked with desirable trees but overstocked with all live trees.

Class 30.—Areas medium to fully stocked with desirable trees and with less than 30 percent of the area controlled by other trees and/or inhibiting vegetation or surface conditions that will prevent occupancy by desirable trees.

Class 40.—Areas medium to fully stocked with desirable trees and with 30 percent or more of the area controlled by other trees and/or conditions that ordinarily prevent occupancy by desirable trees.

Class 50.—Areas poorly stocked with desirable trees but fully stocked with growing-stock trees.

Class 60.—Areas poorly stocked with desirable trees but with medium to full stocking of growing-stock trees.

Class 70.—Areas poorly stocked with desirable trees and poorly stocked with growing-stock trees.

Basal area.—The area in square feet of the cross section at breast height of a single tree. When the basal area of all trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Biomass.—The above-ground volume of all live trees (including bark and foliage) reported in green tons. Biomass is made up of 5 components:

Growing-stock bole.—Biomass of a growing-stock tree from a 1-foot stump to a variable 4-inch top.

Growing-stock tops and limbs.—Biomass of a growing-stock tree from a 1-foot stump minus the growing-stock bole.

Cull bole.—Biomass of a cull tree from a 1-foot stump to a variable 4-inch top.

Cull tops and limbs.—Biomass of a cull tree from a 1-inch stump minus the cull bole.

1- to 5-inch trees.—Biomass of all live trees 1- to 5-inches in diameter at breast height.

Commercial forest land.—Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization. (Note: Areas qualifying as commercial forest land have the capability of producing in excess of 20 cubic feet per acre per year of annual growth under management. Currently inaccessible and inoperable areas are included, except when the areas involved are small and unlikely to become suitable for production of industrial wood in the foreseeable future.) Also see definition of pastured commercial forest land.

Commercial species.—Tree species presently c prospectively suitable for industrial wood pro ucts. (Note: Excludes species of typically sma size, poor form, or inferior quality such as ho hornbeam and hawthorn.)

County and municipal land.—Lands owned b counties and local public agencies or municipal ties, or lands leased to these governmental unit for 50 years or more.

Cull.—Portions of a tree that are unusable for in dustrial wood products, because of rot, form, o other defect.

Desirable trees.—Growing-stock trees having n serious defects in quality limiting present or pro spective use, and of relatively high vigor, and con taining no pathogens that may result in death o serious deterioration before rotation age. These are trees that would be favored by forest managers in silvicultural operations.

Diameter classes.—A classification of trees base on diameter outside bark, measured at breas height (4½ feet above the ground). (Note: d.b.h. is the common abbreviation for diameter at breast height. Two-inch diameter classes are commonly used in Forest Survey, with the even inch the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h. inclusive).

Farm.—Either a place operated as a unit of 10 or more acres from which the sale of agricultural products totals $50 or more annually, or a place operated as a unit of less than 10 acres from which the sale of agricultural products for a year amounts to at least $250. Places having less than the $50 or $250 minimum estimated sales in a given year are also counted as farms if they can normally be expected to produce goods in sufficient quantity to meet the requirements of the definition.

Farmer-owned land.—Land owned by farm operators. (Note: Excludes land leased by farm operators from nonfarm owners, such as railroad companies and States.)

Forest land.—Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use. (Note: Stocking is measured by comparison of basal area and/or number of trees, by age or size and spacing with specified standards.) The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width

of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, or other bodies of water or clearings in forest areas shall be classed as forest if less than 120 feet wide. Also see definitions for land area, commercial forest land, noncommercial forest land, productive-reserved forest land, stocking, unproductive forest land, and water.

Forest industry land.—Land owned by companies or individuals operating primary wood-using plants.

Forest trees.—Woody plants having a well-developed stem and usually more than 12 feet in height at maturity.

Forest type.—A classification of forest land based upon the species forming a plurality of live tree stocking. Major forest types in Michigan are:

Jack pine.—Forests in which jack pine comprises a plurality of the stocking. (Common associates include eastern white pine, red pine, aspen, birch, and maple.)

Red pine.—Forests in which red pine comprises a plurality of the stocking. (Common associates include eastern white pine, jack pine, aspen, birch, and maple.)

White pine.—Forests in which eastern white pine comprises a plurality of the stocking. (Common associates include red pine, jack pine, aspen, birch, and maple.)

Balsam fir.—Forests in which balsam fir and white spruce comprise a plurality of stocking with balsam fir the most common. (Common associates include white spruce, aspen, maple, birch, northern white-cedar, and tamarack.)

White spruce.—Forests in which white spruce and balsam fir comprise a plurality of the stocking with white spruce the most common. (Common associates include balsam fir, aspen, maple, birch, northern white-cedar, and tamarack.)

Black spruce.—Forests in which swamp conifers comprise a plurality of the stocking with black spruce the most common. (Common associates include tamarack and northern white-cedar.)

Northern white-cedar.—Forests in which swamp conifers comprise a plurality of the stocking with northern white-cedar the most common. (Common associates include tamarack and black spruce.)

Tamarack.—Forests in which swamp conifers comprise a plurality of the stocking with tamarack the most common. (Common associates include black spruce and northern white-cedar.)

Oak-hickory.—Forests in which northern red oak, white oak, bur oak, or hickories, singly or in combination, comprise a plurality of the stocking. (Common associates include jack pine, beech, yellow-poplar, elm, and maple.)

Elm-ash-soft maple.—Forests in which lowland elm, ash, cottonwood, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include birches, spruce, and balsam fir.)

Maple-birch.—Forests in which sugar maple, basswood, yellow birch, upland American elm, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include white pine, elm, hemlock, and basswood.)

Aspen.—Forests in which quaking aspen or bigtooth aspen, singly or in combination, comprise a plurality of the stocking. (Common associates include balsam poplar, balsam fir, and paper birch.)

Paper birch.—Forests in which paper birch comprises a plurality of the stocking. (Common associates include maple, aspen, and balsam fir.)

Exotic.—Forests in which species not native to Michigan comprise a plurality of the stocking. (Mostly scotch pine plantations.)

Gross area.—The entire area of land and water as determined by the Bureau of the Census, 1970.

Growing-stock trees.—Live trees of commercial species qualifying as desirable and acceptable trees. (Note: Excludes rough, rotten, and dead trees.)

Growing-stock volume.—Net volume in cubic feet of growing-stock trees 5.0 inches d.b.h. and over, from a 1-foot stump to a minimum 4.0 inch top diameter outside bark of the central stem or to the point where the central stem breaks into limbs. Cubic feet can be converted to cords by multiplying by 79 cubic feet per solid wood cord.

Hardwoods.—Dicotyledonous trees, usually broad-leaved and deciduous.

Idle farmland.—Includes former croplands, orchards, improved pastures, and farm sites not tended within the past 2 years and presently less than 16.7 percent stocked with trees.

Improved pasture.—Land currently improved for grazing, by cultivation, seeding, irrigation, or clearing of trees or brush and less than 16.7 percent stocked with live trees.

Indian land.—Tribal lands held in fee but administered by the Federal Government.

Land area.—A. *Bureau of the Census.* The area of dry land and land temporarily or partly covered by water, such as marshes, swamps, and river flood plains (omitting tidal flats below mean high tide); streams, sloughs, estuaries, and canals less than

one-eighth of a statute mile wide; and lakes, reservoirs, and ponds less than 40 acres in area.

B. *Forest Survey.* The same as the Bureau of the Census, except minimum width of streams, etc. is 120 feet and minimum size of lakes, etc. is 1 acre.

Live trees.—Growing-stock, rough and rotten trees 1 inch d.b.h. and larger.

Log grades.—A classification of logs based on external characteristics as indicators of quality or value. (See Appendix for specific grading factors used.)

Logging residues.—The unused growing stock portions of trees cut or killed by logging.

Maintained road.—Any road, hard-topped or other surfaces, that is plowed or graded at least once a year. Includes rights-of-way that are cut or treated to limit herbaceous growth.

Marsh.—Nonforest land that characteristically supports low, generally herbaceous or shrubby vegetation and that is intermittently covered with water.

Merchantable.—Refers to a pulpwood or saw log section that meets pulpwood or saw log specifications, respectively.

Miscellaneous Federal land.—Federal land other than National Forest, and land administered by the Bureau of Land Management.

Miscellaneous private land.—Privately owned land other than forest-industry and farmer-owned land.

Mortality.—The volume of sound wood in growing-stock and sawtimber trees that die annually.

National Forest land.—Federal land that has been legally designated as National Forest or purchase units, and other land under the administration of the USDA Forest Service.

Net annual growth of growing-stock.— The annual change in volume of sound wood in live sawtimber and poletimber trees and the total volume of trees entering these classes through ingrowth, less volume losses resulting from natural causes.

Net annual growth of sawtimber.—The annual change in the volume of live sawtimber trees and the total volume of trees reaching sawtimber size, less volume losses resulting from natural causes.

Net volume.—Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.

Noncommercial forest land.—(a) Unproductive forest land and (b) productive-reserved forest land.

Noncommercial species.—Tree species of typically small size, poor form, or inferior quality which normally do not develop into trees suitable for industrial wood products.

Nonforest land.—Land that has never supported forests, and land formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide and more than 1 acre in area, to qualify as nonforest land.)

a. *Nonforest land without trees.*—Nonforest land with no live trees present.

b. *Nonforest land with trees.*—Nonforest land with one or more trees per acre at least 5 inches d.b.h.

Nonstocked land.—Commercial forest land less than 16.7 percent stocked with growing-stock trees.

Other removals.—Growing-stock trees removed but not utilized for products, or trees left standing but "removed" from the commercial forest land classification by land use change. Examples are removals from cultural operations such as timber stand improvement work, land clearing, and changes in land use.

Ownership.—Property owned by one owner, regardless of the number of parcels in a specified area.

Ownership size class.—The amount of commercial forest land owned by one owner, regardless of the number or parcels.

Owner tenure.—The length of time a property has been held by the owner.

Physiographic class.—A measure of soil and water conditions that affect tree growth on a site. Physiographic classes used in Resources Evaluation inventories are:

Xeric sites.—Very dry soils where excessive drainage seriously limits both growth and species occurrence. Example: sandy jack pine plains.

Xeromesic sites.—Moderately dry soils where excessive drainage limits growth and species occurrence to some extent. Example: dry oak ridge.

Mesic sites.—Deep, well-drained soils. Growth and species occurrence are limited only by climate.

Hydromesic sites.—Moderately wet soils where

insufficient drainage or infrequent flooding limits growth and species occurrence to some extent. Example: better drained bottomland hardwood sites.

Hydric sites.—Very wet sites where excess water seriously limits both growth and species occurrence. Example: wet, frequently flooded river bottoms and spruce bogs.

Plant byproducts.—Plant residues used for products such as mulch, pulp chips, and fuelwood.

Plant residues.—Wood and bark materials generated at manufacturing plants during production of other products.

Poletimber stands.—(See stand-size class.)

Poletimber trees.—Growing-stock trees of commercial species at least 5.0 inches d.b.h., but smaller than sawtimber size.

Productive-reserved forest land.—Forest land sufficiently productive to qualify as commercial forest land but withdrawn from timber utilization through statute, administrative regulation, designation, or exclusive use for Christmas tree production, as indicated by annual shearing.

Rotten trees.—Live trees of commercial species that do not contain at least one 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough trees.—(a) Live trees of commercial species that do not contain at least one merchantable 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees of noncommercial species.

Roundwood products.—Logs, bolts, or other round sections (including chips from roundwood) cut from trees for industrial or consumer uses. (Note: Includes saw logs, veneer logs and bolts; cooperage logs and bolts; pulpwood; fuelwood; piling; poles; posts; hewn ties; mine timbers; and various other round, split, or hewn products.)

Salvable dead trees.—Standing or down dead trees that are considered merchantable by Regional standards.

Saplings.—Live trees 1.0 to 5.0 inches d.b.h.

Sapling-seedling stands.—(See stand-size class.)

Saw log.—A log meeting minimum standards of diameter, length, and defect, including logs at least 8 feet long, sound and straight and with a minimum diameter outside bark (d.o.b.) for softwoods of 7 inches (9 inches for hardwoods) or other combinations of size and defect specified by Regional standards.

Saw log portion.—That part of the bole of sawtimber trees between the stump and the saw log top.

Saw log top.—The point on the bole of sawtimber trees above which a saw log cannot be produced. The minimum saw log top is 7.0 inches d.o.b. for softwoods and 9.0 inches d.o.b. for hardwoods.

Sawtimber stands.—(See stand-size class.)

Sawtimber trees.—Growing-stock trees of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs 8 feet or longer, and meeting Regional specifications for freedom from defect. Softwoods must be at least 9.0 inches d.b.h. Hardwoods must be at least 11.0 inches d.b.h.

Sawtimber volume.—Net volume of the saw log portion of live sawtimber in board feet, International ¼-inch rule, from stump to a minimum 7 inches top diameter outside bark (d.o.b.) for softwoods and a minimum 9 inches top d.o.b. for hardwoods.

Seedlings.—Live trees less than 1.0 inch d.b.h. that are expected to survive. Only softwood seedlings more than 6 inches tall and hardwood seedlings more than 1 foot tall are counted.

Short-log (rough tree).—Sawtimber-size trees of commercial species that contain at least one merchantable 8-to 11-foot saw log but not a 12-foot saw log.

Shrub biomass.—The total above-ground weight (including the bark) of selected shrubs and trees less than 1 inch d.b.h.

Site class.—A classification of forest land in terms of inherent capacity to grow crops of industrial wood based on fully stocked natural stands.

Site index.—An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Softwoods.—Coniferous trees, usually evergreen, having needles or scale-like leaves.

Stand.—A growth of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

Stand-age class.—Age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Stand-area class.—The extent of a continuous forested area of the same forest type, stand-size class, and stand-density class.

Stand-size class.—A classification of forest land based on the size class of growing-stock trees on the area; that is, sawtimber, poletimber or seedlings and saplings.

a. *Sawtimber stands.*—Stands at least 16.7 percent stocked with growing-stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

b. *Poletimber stands.*—Stands at least 16.7 percent stocked with growing-stock trees of which half or more of this stocking is in poletimber and/or sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

c. *Sapling-seedling stands.*—Stands at least 16.7 percent stocked with growing-stock trees of which more than half of the stocking is saplings and/or seedlings.

d. *Nonstocked stands.*—Stands in which stocking of growing-stock trees is less than 16.7 percent.

State land.—Land owned by States, or land leased to these governmental units for 50 years or more.

Stocking.—The degree of occupancy of land by trees, measured by basal area and/or the number of trees in a stand by size or age and spacing, compared to the basal area and/or number of trees required to fully utilize the growth potential of the land; that is, the stocking standard.

A stocking percent of 100 indicates full utilization of the site and is equivalent to 80 square feet of basal area per acre in trees 5 inches d.b.h. and larger. In a stand of trees less than 5 inches d.b.h., a stocking percent of 100 would indicate that the present number of trees is sufficient to produce 80 square feet of basal area per acre when the trees reach 5 inches d.b.h.

Stands are grouped into the following stocking classes:

Overstocked stands.—Stands in which stocking of trees is 134.0 percent or more.

Fully stocked stands.—Stands in which stocking of trees is from 101.0 to 133.9 percent.

Medium stocked stands.—Stands in which stocking of trees is from 61.0 to 100.9 percent.

Poorly stocked stands.—Stands in which stocking of trees is from 16.7 to 60.9 percent.

Nonstocked areas.—Commercial forest land on which stocking of trees is less than 16.7 percent.

Timber removals from growing stock.—The volume of sound wood in growing-stock trees removed annually for forest products (including roundwood products and logging residues) and for other removals.

Timber removals from sawtimber.—The net board foot volume of live sawtimber trees removed for forest products annually (including roundwood products and logging residues) and for other removals.

Timber products output.—All timber products cut from roundwood and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edging, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulp mills that are used as pulpwood chips or other products.

Tree biomass.—The total aboveground weight (including the bark) of all trees 1 to 5 inches in d.b.h. and the total aboveground weight (including the bark) from a 1-foot stump for trees more than 5 inches in diameter.

Tree size class.—A classification of trees based on diameter at breast height, including sawtimber trees, poletimber trees, and seedlings.

Unproductive forest land.—Forest land incapable of producing 20 cubic feet per acre of annual growth or of yielding crops of industrial wood under natural conditions because of adverse site conditions. (Note: Adverse conditions include shallow soils, dry climate, poor drainage, high elevation, steepness, and rockiness.

Upper stem portion.—That part of the bole of sawtimber trees above the saw log top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Urban and other areas.—Areas within the legal boundaries of cities and towns; suburban areas developed for residential, industrial, or recreational purposes; schoolyards, cemeteries, roads; railroads; airports; beaches; powerlines; and other rights-of-way; or other nonforest land not included in any other specified land use class.

ter.—(a) *Bureau of the Census.*—Streams, sloughs, estuaries, and canals more than one-eighth of a statute mile wide; and lakes, reservoirs, and ponds more than 40 acres in area.

(b) *Noncensus.*—The same as the Bureau of the Census, except minimum width of streams, etc. is 120 feet and minimum size of lakes, etc. is 1 acre.

oded pasture.—Improved pasture with more than 16.7 percent stocking in live trees but less than 25 percent stocking in growing-stock trees. Area is currently improved for grazing or there is other evidence of grazing.

Wooded strip.—An acre or more of natural continuous forest land that would otherwise meet survey standards for commercial forest land except that it is less than 120 feet wide.

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Table 1.--Area of land by land class, Western Upper Peninsula, Michigan, 1966[1/] and 1980

(In thousand acres)

Land class	[1/]1966	1980
FOREST LAND		
Commercial forest		
Jack pine	127.9	88.3
Red pine	59.4	57.6
White pine	70.9	48.7
Balsam fir-white spruce	479.0	407.2
Black spruce	166.8	209.5
Northern white-cedar	255.3	210.2
Tamarack	42.1	36.0
Oak-hickory	72.6	22.6
Elm-ash-soft maple	245.6	169.7
Maple-birch	2,223.5	2,372.4
Aspen	987.2	733.3
Paper birch	121.0	143.8
Exotic	--	1.6
Nonstocked	69.6	28.7
Subtotal	4,920.9	4,529.6
Noncommercial forest land		
Unproductive	77.0	62.2
Productive-reserved	185.4	266.7
Subtotal	262.4	328.9
Total	5,183.3	4,858.5
NONFOREST LAND		
Cropland	217.5	224.5
Pasture and range	63.7	156.0
Other	107.3	287.4
Total	388.5	667.9
TOTAL LAND	[2/]5,571.8	[3/]5,526.4
WATER (BUREAU OF THE CENSUS)	[2/]121.6	[3/]167.0
TOTAL LAND AND WATER	[2/]5,693.4	[3/]5,693.4

[1/]Figures have been adjusted from those published after the 1966 survey to conform to 1980 areas because of changes in survey procedures and definitions.

[2/]U.S. Department of Commerce, Bureau of the Census. 1950.

[3/]U.S. Department of Commerce, Bureau of the Census, 1970. Area Measurement Reports, GE-20, No. 1.

Table 2.--Area of land by land use class and county,
Western Upper Peninsula, Michigan, 1980

(In thousand acres)

Land use class	All counties	County							
		Baraga	Dickinson	Gogebic	Houghton	Iron	Keweenaw	Marquette	Ontonagon
FOREST LAND									
Commercial forest	4,529.6	513.2	376.6	619.9	513.7	654.0	207.1	970.4	674.7
Unproductive forest	62.2	5.4	1.5	11.1	8.6	9.2	--	23.6	2.8
Productive reserved	266.7	21.2	2.9	23.6	11.4	1.5	126.0	32.9	47.2
Total	4,858.5	539.8	381.0	654.6	533.7	664.7	333.1	1,026.9	724.7
NONFOREST LAND									
Nonforest with trees									
Cropland with trees	3.5	--	--	--	--	--	--	--	3.5
Improved pasture with trees	12.7	--	5.5	--	--	5.4	--	1.8	--
Wooded strips	--	--	--	--	--	--	--	--	--
Idle farmland with trees	--	--	--	--	--	--	--	--	--
Marsh with trees	15.1	1.5	--	7.4	--	2.5	1.9	--	1.8
Urban and other windbreaks	--	--	--	--	--	--	--	--	--
Windbreaks	--	--	--	--	--	--	--	--	--
Wooded pasture	1.8	--	--	--	1.8	--	--	--	--
Subtotal	33.1	1.5	5.5	7.4	1.8	7.9	1.9	1.8	5.3
Nonforest without trees									
Cropland without trees	189.2	9.9	29.9	9.3	56.1	11.7	--	14.3	58.0
Improved pasture without trees	141.5	5.9	26.2	10.9	23.5	24.8	1.6	30.0	18.6
Idle farm without trees	--	--	--	--	--	--	--	--	--
Marsh without trees	89.1	11.5	12.5	3.8	7.3	20.2	3.3	28.4	2.1
Other farm-farmstead	31.8	2.0	2.2	1.5	3.6	3.4	--	8.7	10.4
Urban and other	183.2	5.9	27.3	20.9	24.9	16.8	4.2	60.3	22.9
Subtotal	634.8	35.2	98.1	46.4	115.4	76.9	9.1	141.7	112.0
Total	667.9	36.7	103.6	53.8	117.2	84.8	11.0	143.5	117.3
TOTAL LAND	5,526.4	576.5	484.6	708.4	650.9	749.5	344.1	1,170.4	842.0
WATER (BUREAU OF THE CENSUS)	167.0	15.5	3.7	25.0	19.2	30.7	31.6	31.5	9.8
TOTAL LAND AND WATER	5,693.4	592.0	488.3	733.4	670.1	780.2	375.7	1,201.9	851.8

Table 3.--Area of commercial forest land by ownership class and county, Western Upper Peninsula, Michigan, 1980

(In thousand acres)

Ownership class	All counties	County							
		Baraga	Dickinson	Gogebic	Houghton	Iron	Keweenaw	Marquette	Ontonagon
National Forest	827.7	37.7	--	259.4	129.7	152.4	--	5.7	242.8
Bureau of Land Mgmt.	--	--	--	--	--	--	--	--	--
Miscellaneous federal	1.6	--	--	--	--	--	1.6	--	--
Indian	16.3	16.3	--	--	--	--	--	--	--
State	620.3	65.9	182.8	--	43.9	90.1	2.7	218.5	16.4
County and municipal	87.6	1.3	1.6	67.4	--	3.2	--	10.8	3.3
Forest industry	1,269.3	291.9	31.2	134.2	90.2	197.2	36.7	297.7	190.2
Farmer	194.1	28.9	28.9	8.3	19.3	29.1	--	44.7	34.9
Misc. private-corp.	668.4	14.5	28.1	93.3	112.9	44.9	135.7	135.8	103.2
Misc. private-indiv.	844.3	56.7	104.0	57.3	117.7	137.1	30.4	257.2	83.9
All owners	4,529.6	513.2	376.6	619.9	513.7	654.0	207.1	970.4	674.7

Table 4.--Area of commercial forest land by forest type, physiographic class, and ownership class, Western Upper Peninsula, Michigan, 1980

(In thousand acres)

Forest type and physiographic class	All owners	Ownership class									
		National Forest	Bureau of Land Mgmt.	Misc. Federal	Indian	State	County & municipal	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.
Jack pine											
Hydric	1.6	--	--	--	--	--	--	1.6	--	--	--
Hydromesic	--	--	--	--	--	--	--	--	--	--	--
Mesic	17.9	6.3	--	--	--	3.4	--	1.7	--	1.7	4.8
Xeromesic	53.3	12.7	--	--	--	20.5	2.9	3.1	--	4.4	9.7
Xeric	15.5	6.3	--	--	--	1.6	4.7	1.2	--	--	1.7
All classes	88.3	25.3	--	--	--	25.5	7.6	7.6	--	6.1	16.2
Red pine											
Hydric	--	--	--	--	--	--	--	--	--	--	--
Hydromesic	3.3	--	--	--	--	--	--	--	--	3.3	--
Mesic	33.1	21.5	--	--	--	5.2	--	1.7	--	--	4.7
Xeromesic	21.2	15.4	--	--	--	4.1	--	--	--	1.7	--
Xeric	--	--	--	--	--	--	--	--	--	--	--
All classes	57.6	36.9	--	--	--	9.3	--	1.7	--	5.0	4.7
White pine											
Hydric	--	--	--	--	--	--	--	--	--	--	--
Hydromesic	3.0	--	--	--	--	1.7	--	1.3	--	--	--
Mesic	42.3	11.1	--	--	--	9.9	--	9.5	3.4	6.8	1.6
Xeromesic	3.4	--	--	--	--	1.7	--	--	--	1.7	--
Xeric	--	--	--	--	--	--	--	--	--	--	--
All classes	48.7	11.1	--	--	--	13.3	--	10.8	3.4	8.5	1.6
Balsam fir											
Hydric	30.4	8.7	--	--	--	2.3	--	11.3	1.3	5.4	1.4
Hydromesic	187.4	19.7	--	--	--	35.1	1.6	58.9	2.9	21.7	47.5
Mesic	143.9	44.2	--	1.6	--	22.5	1.7	31.2	3.3	13.3	26.1
Xeromesic	4.9	--	--	--	--	1.6	--	1.7	1.6	--	--
Xeric	--	--	--	--	--	--	--	--	--	--	--
All classes	366.6	72.6	--	1.6	--	61.5	3.3	103.1	9.1	40.4	75.0
White spruce											
Hydric	1.4	--	--	--	--	1.4	--	--	--	--	--
Hydromesic	8.2	--	--	--	--	1.7	--	3.2	--	1.6	1.7
Mesic	27.4	--	--	--	--	6.6	--	12.9	1.7	5.0	1.2
Xeromesic	3.6	--	--	--	--	--	--	2.0	--	--	1.6
Xeric	--	--	--	--	--	--	--	--	--	--	--
All classes	40.6	--	--	--	--	9.7	--	18.1	1.7	6.6	4.5

(Table 4 continued on next page)

(Table 4 continued)

Forest type and physiographic class	All owners	Ownership class									
		National Forest	Bureau of Land Mgmt.	Misc. Federal	Indian	State	County & municipal	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.
Black spruce											
Hydric	73.8	12.0	--	--	--	12.3	1.6	25.0	1.6	3.9	17.4
Hydromesic	113.0	33.2	--	--	--	30.3	1.7	14.8	.0	6.7	26.3
Mesic	20.0	7.5	--	--	--	6.4	--	1.4	1.7	1.3	1.7
Xeromesic	2.7	--	--	--	--	--	--	1.5	--	1.2	--
Xeric	--	--	--	--	--	--	--	--	--	--	--
All classes	209.5	1/52.7	--	--	--	49.0	3.3	42.7	3.3	13.1	45.4
Northern white-cedar											
Hydric	25.9	--	--	--	--	4.5	1.3	13.3	--	4.0	2.8
Hydromesic	171.3	--	--	--	--	46.5	4.8	57.0	3.1	34.1	25.8
Mesic	13.0	--	--	--	--	1.6	1.6	4.9	--	4.9	--
Xeromesic	--	--	--	--	--	--	--	--	--	--	--
Xeric	--	--	--	--	--	--	--	--	--	--	--
All classes	210.2	--	--	--	--	52.6	7.7	75.2	3.1	43.0	28.6
Tamarack											
Hydric	20.8	--	--	--	--	8.3	--	5.6	1.8	3.9	1.2
Hydromesic	15.2	--	--	--	--	4.1	--	4.5	1.6	--	5.0
Mesic	--	--	--	--	--	--	--	--	--	--	--
Xeromesic	--	--	--	--	--	--	--	--	--	--	--
Xeric	--	--	--	--	--	--	--	--	--	--	--
All classes	36.0	--	--	--	--	12.4	--	10.1	3.4	3.9	6.2
Oak-hickory											
Hydric	--	--	--	--	--	--	--	--	--	--	--
Hydromesic	3.2	--	--	--	--	1.6	--	1.6	--	--	--
Mesic	16.0	--	--	--	--	1.5	--	1.7	--	6.4	6.4
Xeromesic	3.4	--	--	--	--	--	--	--	--	3.4	--
Xeric	--	--	--	--	--	--	--	--	--	--	--
All classes	22.6	--	--	--	--	3.1	--	3.3	--	9.8	6.4
Elm-ash-soft maple											
Hydric	7.8	--	--	--	--	1.4	--	3.6	--	--	2.8
Hydromesic	158.5	13.6	--	--	--	23.2	8.4	45.7	15.9	22.2	29.5
Mesic	3.4	--	--	--	--	--	--	--	--	1.3	2.1
Xeromesic	--	--	--	--	--	--	--	--	--	--	--
Xeric	--	--	--	--	--	--	--	--	--	--	--
All classes	169.7	13.6	--	--	--	24.6	8.4	49.3	15.9	23.5	34.4

(Table 4 continued on next page)

(Table 4 continued)

Forest type and physiographic class	All owners	Ownership class									
		National Forest	Bureau of Land Mgmt.	Misc. Federal	Indian	State	County & municipal	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.
Maple-birch											
Hydric	2.3	--	--	--	--	--	--	--	--	--	2.3
Hydromesic	178.1	53.0	--	--	--	12.9	4.9	46.9	6.0	35.3	19.1
Mesic	2,173.4	360.2	--	--	9.6	187.0	37.4	734.0	98.9	343.5	402.8
Xeromesic	18.6	10.4	--	--	--	--	--	4.9	--	2.9	0.4
Xeric	--	--	--	--	--	--	--	--	--	--	--
All classes	2,372.4	423.6	--	--	9.6	199.9	42.3	785.8	104.9	381.7	424.6
Aspen											
Hydric	3.3	--	--	--	--	0.9	--	--	--	--	2.4
Hydromesic	98.4	22.9	--	--	1.6	16.5	--	20.9	2.7	12.6	21.2
Mesic	610.8	133.4	--	--	5.1	118.6	11.7	95.8	33.7	85.9	126.6
Xeromesic	20.8	7.7	--	--	--	4.6	--	--	1.7	3.4	3.4
Xeric	--	--	--	--	--	--	--	--	--	--	--
All classes	733.3	164.0	--	--	6.7	140.6	11.7	116.7	38.1	101.9	153.6
Paper birch											
Hydric	1.3	--	--	--	--	--	--	--	1.3	--	--
Hydromesic	16.0	--	--	--	--	--	--	4.7	1.7	3.3	6.3
Mesic	126.5	16.7	--	--	--	16.5	3.3	37.7	6.6	19.9	25.8
Xeromesic	--	--	--	--	--	--	--	--	--	--	--
Xeric	--	--	--	--	--	--	--	--	--	--	--
All classes	143.8	16.7	--	--	--	16.5	3.3	42.4	9.6	23.2	32.1
Exotic											
Hydric	--	--	--	--	--	--	--	--	--	--	--
Hydromesic	--	--	--	--	--	--	--	--	--	--	--
Mesic	1.6	--	--	--	--	--	--	--	1.6	--	--
Xeromesic	--	--	--	--	--	--	--	--	--	--	--
Xeric	--	--	--	--	--	--	--	--	--	--	--
All classes	1.6	--	--	--	--	--	--	--	1.6	--	--
Nonstocked											
Hydric	3.7	--	--	--	--	2.3	--	--	--	--	1.4
Hydromesic	2.9	--	--	--	--	--	--	--	--	--	2.9
Mesic	15.2	11.2	--	--	--	--	--	--	--	--	4.0
Xeromesic	2.9	--	--	--	--	--	--	--	--	1.7	1.2
Xeric	4.0	--	--	--	--	--	--	2.5	--	--	1.5
All classes	28.7	11.2	--	--	--	2.3	--	2.5	--	1.7	11.0
All types											
Hydric	172.3	20.7	--	--	--	33.4	2.9	60.4	6.0	17.2	31.7
Hydromesic	958.5	142.4	--	--	1.6	173.6	21.4	259.5	33.9	140.8	185.3
Mesic	3,244.5	612.1	--	1.6	14.7	379.2	55.7	932.5	150.9	490.0	607.8
Xeromesic	134.8	46.2	--	--	--	32.5	2.9	13.2	3.3	20.4	16.3
Xeric	19.5	6.3	--	--	--	1.6	4.7	3.7	--	--	3.2
All classes	4,529.6	827.7	--	1.6	16.3	620.3	87.6	1,269.3	194.1	668.4	844.3

1/Classified as mixed swamp conifer on Ottawa National Forest land management plan.

Table 5.--Area of commercial forest land by ownership class and site class, Western Upper Peninsula, Michigan, 1980

(In thousand acres)

Ownership class	All classes	Site class (cubic feet of growth/acre/year)					
		225+	165-224	120-164	85-119	50-84	20-49
National Forest	827.7	--	--	17.0	187.4	395.3	228.0
Bureau of Land Mgmt.	--	--	--	--	--	--	--
Miscellaneous federal	1.6	--	--	--	1.6	--	--
Indian	16.3	--	--	--	1.7	13.1	1.5
State	620.3	--	3.3	19.9	106.8	253.8	236.5
County and municipal	87.6	--	--	--	8.3	43.7	35.6
Forest industry	1,269.3	--	--	17.8	165.1	488.3	598.1
Farmer	194.1	--	--	--	42.1	100.4	51.6
Misc. private-corp.	668.4	--	--	14.1	95.0	270.5	288.8
Misc. private-indiv.	844.3	--	1.6	23.7	148.0	378.9	292.1
All owners	4,529.6	--	4.9	92.5	756.0	1,944.0	1,732.2

Table 6.--Area of commercial forest land by ownership class and stand-volume class, Western Upper Peninsula, Michigan, 1980

(In thousand acres)

Ownership class	All classes	Stand-volume class (board feet[1])		
		Less than 1,500	1,500 to 5,000	5,000+
National Forest	827.7	253.6	414.5	159.6
Bureau of Land Mgmt.	--	--	--	--
Miscellaneous federal	1.6	--	1.6	--
Indian	16.3	3.1	8.3	4.9
State	620.3	246.3	245.9	128.1
County and municipal	87.6	28.8	52.3	6.5
Forest industry	1,269.3	310.7	585.3	373.3
Farmer	194.1	85.3	88.1	20.7
Misc. private-corp.	668.4	170.5	312.4	185.5
Misc. private-indiv.	844.3	308.4	386.4	149.5
All owners	4,529.6	1,406.7	2,094.8	1,028.1

[1]/International 1/4-inch rule.

Table 7.--Area of privately owned commercial forest land by ownership class, owner tenure, and size of owner, Western Upper Peninsula, Michigan, 1980

(In thousand acres)

ership class / owner tenure class	Total	Size of owner (acres)								
		1-4	5-10	11-20	21-50	51-100	101-500	501-2,500	2,501-5,000	5001+
est Industry										
1-4 years	220.3	--	--	--	1.6	--	1.6	4.7	--	212.4
5-9 years	69.3	--	--	--	2.3	--	1.6	4.8	--	60.6
-19 years	355.1	--	--	--	--	--	--	1.6	4.9	348.6
20+ years	624.6	--	--	--	--	--	3.3	1.5	3.2	616.6
All classes	1,269.3	--	--	--	3.9	--	6.5	12.6	8.1	1,238.2
mer										
1-4 years	51.0	--	--	3.4	6.5	8.2	31.3	1.6	--	--
5-9 years	34.5	--	1.7	--	5.0	8.9	12.4	6.5	--	--
-19 years	36.6	--	--	--	9.7	12.8	10.9	1.6	--	1.6
20+ years	72.0	--	3.2	4.9	11.1	25.1	27.7	--	--	--
All classes	194.1	--	4.9	8.3	32.3	55.0	82.3	9.7	--	1.6
c. priv.-corporation										
1-4 years	41.4	--	--	--	--	--	7.2	9.1	--	25.1
5-9 years	43.4	--	--	--	3.3	--	5.0	--	--	35.1
-19 years	209.6	--	--	--	1.6	--	4.5	1.6	4.9	197.0
20+ years	374.0	--	--	--	--	1.7	11.2	11.6	4.8	344.7
All classes	668.4	--	--	--	4.9	1.7	27.9	22.3	9.7	601.9
c. priv.-individual										
1-4 years	217.0	2.8	--	9.9	58.4	48.2	68.4	12.0	4.8	12.5
5-9 years	166.7	--	1.6	11.0	44.5	30.9	62.8	12.5	1.8	1.6
-19 years	200.3	3.2	--	--	55.8	36.8	75.4	19.2	4.9	5.0
20+ years	260.3	1.7	--	3.2	71.3	52.6	83.5	28.9	1.6	17.5
All classes	844.3	7.7	1.6	24.1	230.0	168.5	290.1	72.6	13.1	36.6
private owners										
1-4 years	529.7	2.8	.0	13.3	66.5	56.4	108.5	27.4	4.8	250.0
5-9 years	313.9	.0	3.3	11.0	55.1	39.8	81.8	23.8	1.8	97.3
-19 years	801.6	3.2	.0	.0	67.1	49.6	90.8	24.0	14.7	552.2
20+ years	1,330.9	1.7	3.2	8.1	82.4	79.4	125.7	42.0	9.6	978.8
All classes	2,976.1	7.7	6.5	32.4	271.2	225.2	406.8	117.2	30.9	1,878.3

Table 8.--Area of commercial forest land by forest type, stand-size class, and ownership class, Western Upper Peninsula, Michigan, 1980

(In thousand acres)

Forest type and stand-size class	All owners	Ownership class									
		National Forest	Bureau of Land Mgmt.	Misc. federal	Indian	State	County & municipal	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.
Jack pine											
Sawtimber	39.4	--	--	--	--	17.6	4.8	3.3	--	1.6	12.1
Poletimber	41.9	25.3	--	--	--	5.8	1.6	3.1	--	4.5	1.6
Sapling & seedling	7.0	--	--	--	--	2.1	1.2	1.2	--	--	2.5
All stands	88.3	25.3	--	--	--	25.5	7.6	7.6	--	6.1	16.2
Red pine											
Sawtimber	21.9	5.9	--	--	--	4.6	--	1.7	--	5.0	4.7
Poletimber	21.4	18.6	--	--	--	2.8	--	--	--	--	--
Sapling & seedling	14.3	12.4	--	--	--	1.9	--	--	--	--	--
All stands	57.6	36.9	--	--	--	9.3	--	1.7	--	5.0	4.7
White pine											
Sawtimber	42.0	11.1	--	--	--	10.0	--	9.1	1.7	8.5	1.6
Poletimber	6.7	--	--	--	--	3.3	--	1.7	1.7	--	--
Sapling & seedling	--	--	--	--	--	--	--	--	--	--	--
All stands	48.7	11.1	--	--	--	13.3	--	10.8	3.4	8.5	1.6
Balsam fir											
Sawtimber	77.6	--	--	1.6	--	16.4	--	26.1	2.9	8.1	22.5
Poletimber	193.3	55.2	--	--	--	35.4	1.7	38.0	2.9	22.0	38.1
Sapling & seedling	95.7	17.4	--	--	--	9.7	1.6	39.0	3.3	10.3	14.4
All stands	366.6	72.6	--	1.6	--	61.5	3.3	103.1	9.1	40.4	75.0
White spruce											
Sawtimber	13.5	--	--	--	--	--	--	5.3	--	6.6	1.6
Poletimber	22.2	--	--	--	--	4.8	--	12.8	1.7	--	2.9
Sapling & seedling	4.9	--	--	--	--	4.9	--	--	--	--	--
All stands	40.6	--	--	--	--	9.7	--	18.1	1.7	6.6	4.5
Black spruce											
Sawtimber	7.2	--	--	--	--	4.3	--	--	--	1.2	1.7
Poletimber	98.1	45.8	--	--	--	13.5	1.7	14.0	--	1.6	21.5
Sapling & seedling	104.2	6.9	--	--	--	31.2	1.6	28.7	3.3	10.3	22.2
All stands	209.5	1/52.7	--	--	--	49.0	3.3	42.7	3.3	13.1	45.4
Northern white-cedar											
Sawtimber	88.3	--	--	--	--	8.9	3.2	39.0	--	31.2	6.0
Poletimber	97.1	--	--	--	--	39.5	3.2	30.1	1.7	7.2	15.4
Sapling & seedling	24.8	--	--	--	--	4.2	1.3	6.1	1.4	4.6	7.2
All stands	210.2	--	--	--	--	52.6	7.7	75.2	3.1	43.0	28.6

(Table 8 continued on next page)

(Table 8 continued)

Forest type and stand-size class	All owners	Ownership class									
		National Forest	Bureau of Land Mgmt.	Misc. federal	Indian	State	County & municipal	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.
Tamarack											
Sawtimber	4.6	--	--	--	--	0.9	--	--	--	2.4	1.3
Poletimber	9.6	--	--	--	--	1.6	--	6.2	1.8	--	--
Sapling & seedling	21.8	--	--	--	--	9.9	--	3.9	1.6	1.5	4.9
All stands	36.0	--	--	--	--	12.4	--	10.1	3.4	3.9	6.2
Oak-hickory											
Sawtimber	11.0	--	--	--	--	3.1	--	3.3	--	3.1	1.5
Poletimber	10.0	--	--	--	--	--	--	--	--	6.7	3.3
Sapling & seedling	1.6	--	--	--	--	--	--	--	--	--	1.6
All stands	22.6	--	--	--	--	3.1	--	3.3	--	9.8	6.4
Elm-ash-soft maple											
Sawtimber	63.2	5.5	--	--	--	8.2	--	21.8	1.5	14.1	12.1
Poletimber	67.0	8.1	--	--	--	6.3	8.4	23.0	9.8	3.2	8.2
Sapling & seedling	39.5	--	--	--	--	10.1	--	4.5	4.6	6.2	14.1
All stands	169.7	13.6	--	--	--	24.6	8.4	49.3	15.9	23.5	34.4
Maple-birch											
Sawtimber	1,144.2	161.1	--	--	3.2	111.7	8.2	484.4	28.3	192.9	154.4
Poletimber	1,028.9	249.7	--	--	6.4	70.1	30.8	236.0	64.9	146.9	224.1
Sapling & seedling	199.3	12.8	--	--	--	18.1	3.3	65.4	11.7	41.9	46.1
All stands	2,372.4	423.6	--	--	9.6	199.9	42.3	785.8	104.9	381.7	424.6
Aspen											
Sawtimber	113.6	--	--	--	--	23.2	3.3	21.5	11.0	24.9	29.7
Poletimber	406.6	115.1	--	--	5.1	57.5	5.0	54.3	18.4	54.1	97.1
Sapling & seedling	213.1	48.9	--	--	1.6	59.9	3.4	40.9	8.7	22.9	26.8
All stands	733.3	164.0	--	--	6.7	140.6	11.7	116.7	38.1	101.9	153.6
Paper birch											
Sawtimber	21.1	--	--	--	--	1.6	--	8.2	--	6.6	4.7
Poletimber	101.7	16.7	--	--	--	14.9	--	27.5	6.6	14.8	21.2
Sapling & seedling	21.0	--	--	--	--	--	3.3	6.7	3.0	1.8	6.2
All stands	143.8	16.7	--	--	--	16.5	3.3	42.4	9.6	23.2	32.1
Exotic											
Sawtimber	--	--	--	--	--	--	--	--	--	--	--
Poletimber	--	--	--	--	--	--	--	--	--	--	--
Sapling & seedling	1.6	--	--	--	--	--	--	--	1.6	--	--
All stands	1.6	--	--	--	--	--	--	--	1.6	--	--
Nonstocked	28.7	11.2	--	--	--	2.3	--	2.5	--	1.7	11.0
All types											
Sawtimber	1,647.6	183.6	--	1.6	3.2	210.5	19.5	623.7	45.4	306.2	253.9
Poletimber	2,104.5	534.5	--	--	11.5	255.5	52.4	446.7	109.5	261.0	433.4
Sapling & seedling	748.8	98.4	--	--	1.6	152.0	15.7	196.4	39.2	99.5	146.0
Nonstocked	28.7	11.2	--	--	--	2.3	--	2.5	--	1.7	11.0
All stands	4,529.6	827.7	--	1.6	16.3	620.3	87.6	1,269.3	194.1	668.4	844.3

1/Classified as mixed swamp conifer on Ottowa National Forest land management plan.

Table 9.--Area of commercial forest land by forest type and county, Western Upper Peninsula, Michigan, 1980

(In thousand acres)

Forest type	All counties	County							
		Baraga	Dickinson	Gogebic	Houghton	Iron	Keweenaw	Marquette	Ontonagon
Jack pine	88.3	4.3	1.7	2.6	12.0	7.2	--	55.3	5.2
Red pine	57.6	4.1	4.8	9.0	12.0	6.5	1.7	9.0	10.5
White pine	48.7	.1	1.7	0.9	2.8	14.1	3.4	17.5	8.2
Balsam fir	366.6	41.4	41.5	48.5	20.9	80.6	16.0	82.6	35.1
White spruce	40.6	1.5	4.9	--	1.2	6.7	--	11.7	14.6
Black spruce	209.5	20.0	20.8	33.2	9.7	36.0	2.4	79.1	8.3
Northern white-cedar	210.2	28.9	46.7	12.9	13.5	10.4	36.7	61.1	--
Tamarack	36.0	5.5	3.5	2.7	3.9	15.6	--	4.8	--
Oak-hickory	22.6	--	1.5	3.2	1.6	--	8.1	8.2	--
Elm-ash-soft maple	169.7	18.0	13.0	36.8	17.0	6.9	6.1	42.1	29.8
Maple-birch	2,372.4	335.0	103.6	386.5	345.2	294.1	99.8	421.6	386.6
Aspen	733.3	40.7	116.4	68.7	57.5	149.8	15.0	121.7	163.5
Paper birch	143.8	10.8	13.4	11.1	10.7	23.8	17.9	48.9	7.2
Exotic	1.6	--	--	--	--	--	--	1.6	--
Nonstocked	28.7	2.9	3.1	3.8	5.7	2.3	--	5.2	5.7
All types	4,529.6	513.2	376.6	619.9	513.7	654.0	207.1	970.4	674.7

Table 10.--Area of commercial forest land by county and stand-size class, Western Upper Peninsula, Michigan, 1980

(In thousand acres)

County	All stands	Stand-size class			
		Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
Baraga	513.2	283.8	154.4	72.1	2.9
Dickinson	376.6	74.1	190.8	108.6	3.1
Gogebic	619.9	168.3	354.3	93.5	3.8
Houghton	513.7	212.5	233.8	61.7	5.7
Iron	654.0	208.9	309.1	133.7	2.3
Keweenaw	207.1	121.2	62.2	23.7	--
Marquette	970.4	367.1	436.2	161.9	5.2
Ontonagon	674.7	211.7	363.7	93.6	5.7
All counties	4,529.6	1,647.6	2,104.5	748.8	28.7

Table 11.--Area of commercial forest land by forest type, stand-size class, and site class, Western Upper Peninsula, Michigan, 1980

(In thousand acres)

Forest type and stand-size class	All classes	Site class (cubic feet of growth/acre/year)					
		225+	165-224	120-164	85-119	50-84	20-49
Jack pine							
Sawtimber	39.4	--	--	--	11.9	21.0	6.5
Poletimber	41.9	--	--	--	--	37.5	4.4
Sapling & seedling	7.0	--	--	--	--	2.8	4.2
All stands	88.3	--	--	--	11.9	61.3	15.1
Red pine							
Sawtimber	21.9	--	--	--	3.3	15.3	3.3
Poletimber	21.4	--	--	7.2	14.2	--	--
Sapling & seedling	14.3	--	--	--	--	14.3	--
All stands	57.6	--	--	7.2	17.5	29.6	3.3
White pine							
Sawtimber	42.0	--	--	1.6	6.3	32.4	1.7
Poletimber	6.7	--	--	--	3.4	3.3	--
Sapling & seedling	--	--	--	--	--	--	--
All stands	48.7	--	--	1.6	9.7	35.7	1.7
Balsam fir							
Sawtimber	77.6	--	1.7	14.7	39.6	12.6	9.0
Poletimber	193.3	--	3.2	37.2	102.1	41.5	9.3
Sapling & seedling	95.7	--	--	4.7	39.6	17.1	34.3
All stands	366.6	--	4.9	56.6	181.3	71.2	52.6
White spruce							
Sawtimber	13.5	--	--	--	--	10.3	3.2
Poletimber	22.2	--	--	--	12.9	7.6	1.7
Sapling & seedling	4.9	--	--	--	--	4.9	--
All stands	40.6	--	--	--	12.9	22.8	4.9
Black spruce							
Sawtimber	7.2	--	--	--	--	2.9	4.3
Poletimber	98.1	--	--	--	4.4	15.5	78.2
Sapling & seedling	104.2	--	--	--	0.4	6.8	97.0
All stands	209.5	--	--	--	4.8	25.2	179.5
Northern white-cedar							
Sawtimber	88.3	--	--	--	--	13.5	74.8
Poletimber	97.1	--	--	--	--	3.2	93.9
Sapling & seedling	24.8	--	--	--	--	1.6	23.2
All stands	210.2	--	--	--	--	18.3	191.9

(Table 11 continued on next page)

(Table 11 continued)

Forest type and stand-size class	All classes	Site class (cubic feet of growth/acre/year)					
		225+	165-224	120-164	85-119	50-84	20-49
Tamarack							
Sawtimber	4.6	--	--	--	--	2.2	2.4
Poletimber	9.6	--	--	--	--	3.4	6.2
Sapling & seedling	21.8	--	--	--	--	3.5	18.3
All stands	36.0	--	--	--	--	9.1	26.9
Oak-hickory							
Sawtimber	11.0	--	--	--	--	4.6	6.4
Poletimber	10.0	--	--	--	1.6	6.8	1.6
Sapling & seedling	1.6	--	--	--	--	1.6	--
All stands	22.6	--	--	--	1.6	13.0	8.0
Elm-ash-soft maple							
Sawtimber	63.2	--	--	--	1.6	12.5	49.1
Poletimber	67.0	--	--	--	--	11.5	55.5
Sapling & seedling	39.5	--	--	--	--	7.8	31.7
All stands	169.7	--	--	--	1.6	31.8	136.3
Maple-birch							
Sawtimber	1,144.2	--	--	4.8	103.5	532.0	503.9
Poletimber	1,028.9	--	--	3.1	105.2	577.9	342.7
Sapling & seedling	199.3	--	--	--	19.8	86.5	93.0
All stands	2,372.4	--	--	7.9	228.5	1,196.4	939.6
Aspen							
Sawtimber	113.6	--	--	6.4	43.0	52.9	11.3
Poletimber	406.6	--	--	6.7	163.7	200.2	36.0
Sapling & seedling	213.1	--	--	5.1	78.2	97.0	32.8
All stands	733.3	--	--	18.2	284.9	350.1	80.1
Paper birch							
Sawtimber	21.1	--	--	--	--	1.6	19.5
Poletimber	101.7	--	--	--	--	55.6	46.1
Sapling & seedling	21.0	--	--	--	--	5.0	16.0
All stands	143.8	--	--	--	--	62.2	81.6
Exotic							
Sawtimber	--	--	--	--	--	--	--
Poletimber	--	--	--	--	--	--	--
Sapling & seedling	1.6	--	--	--	--	1.6	--
All stands	1.6	--	--	--	--	1.6	--
Nonstocked	28.7	--	--	1.0	1.3	15.7	10.7
All types							
Sawtimber	1,647.6	--	1.7	27.5	209.2	713.8	695.4
Poletimber	2,104.5	--	3.2	54.2	407.5	964.0	675.6
Sapling & seedling	748.8	--	--	9.8	138.0	250.5	350.5
Nonstocked	28.7	--	--	1.0	1.3	15.7	10.7
All stands	4,529.6	--	4.9	92.5	756.0	1,944.0	1,732.2

Western Upper Peninsula, Michigan, 1980

(In thousand acres)

Forest type	All ages	Stand-age class (years) 1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	88.3	1.2	4.5	7.6	13.4	21.8	28.6	4.7	3.1	1.7	1.7	--	--	--
Red pine	57.6	--	16.9	8.1	10.8	--	1.7	5.9	1.3	3.2	3.4	4.8	1.5	--
White pine	48.7	--	--	1.7	1.7	1.6	--	14.5	3.4	12.7	5.0	3.2	3.3	1.6
Balsam fir	366.6	29.2	32.7	37.1	35.0	55.2	55.8	35.5	34.0	16.1	13.1	15.1	2.9	4.9
White spruce	40.6	3.3	1.6	--	12.3	5.1	6.5	1.7	2.0	--	--	8.1	--	--
Black spruce	209.5	20.7	29.0	38.9	18.3	20.4	27.7	19.0	9.5	--	2.9	11.8	7.3	4.0
Northern white-cedar	210.2	4.7	7.5	9.8	2.8	11.8	17.8	26.0	22.3	26.6	11.6	39.7	15.1	14.5
Tamarack	36.0	5.1	7.0	5.5	1.4	4.4	5.8	1.6	--	--	2.9	--	--	2.3
Oak-hickory	22.6	--	--	1.6	1.7	4.9	--	3.3	--	1.5	3.1	4.9	1.6	--
Elm-ash-soft maple	169.7	15.5	17.7	8.0	9.8	11.5	13.4	13.1	14.6	13.9	8.4	16.6	14.3	12.9
Maple-birch	2,372.4	81.2	81.3	50.4	125.2	370.1	372.8	150.7	162.2	190.5	207.4	349.6	163.5	67.5
Aspen	733.3	113.5	82.1	27.1	81.4	151.0	138.0	51.2	51.9	24.5	5.0	7.6	--	--
Paper birch	143.8	5.0	10.9	5.0	8.0	14.7	42.9	26.1	9.9	8.1	6.6	--	5.0	1.6
Exotic	1.6	1.6	--	--	--	--	--	--	--	--	--	--	--	--
Nonstocked	28.7	21.2	5.9	--	1.6	--	--	--	--	--	--	--	--	--
All types	4,529.6	302.2	297.1	200.8	323.4	672.5	711.0	353.3	314.2	298.8	271.1	461.4	214.5	109.3

Table 13.--Area of commercial forest land by forest type and site-index class, Western Upper Peninsula, Michigan, 1980

(In thousand acres)

Forest type	All classes	Site-index class (feet) 11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91+
Jack pine	88.3	--	--	1.7	5.9	10.2	45.0	15.2	10.3	--
Red pine	57.6	--	--	--	19.3	13.6	6.8	17.9	--	--
White pine	48.7	--	--	--	8.1	29.3	9.7	1.6	--	--
Balsam fir	366.6	1.4	6.5	44.8	92.0	146.4	57.0	5.0	11.9	1.6
White spruce	40.6	--	--	3.3	9.8	13.0	3.3	11.2	--	--
Black spruce	209.5	--	35.6	88.5	55.5	25.1	4.4	0.4	--	--
Northern white-cedar	210.2	16.3	103.8	58.3	18.2	2.7	10.9	--	--	--
Tamarack	36.0	--	--	12.9	14.1	5.2	3.8	--	--	--
Oak-hickory	22.6	--	--	1.7	3.2	4.7	11.4	1.6	--	--
Elm-ash-soft maple	169.7	--	3.0	39.2	41.0	35.2	35.5	14.2	1.6	--
Maple-birch	2,372.4	--	9.3	51.7	267.1	616.8	825.5	463.1	126.2	12.7
Aspen	733.3	--	--	5.3	31.9	127.4	217.3	232.0	101.2	18.2
Paper birch	143.8	--	1.3	3.1	6.7	62.1	54.6	16.0	--	--
Exotic	1.6	--	--	--	--	1.6	--	--	--	--
Nonstocked	28.7	--	2.3	2.6	2.8	17.0	2.9	1.1	--	--
All types	4,529.6	17.7	161.8	313.1	575.6	1,110.3	1,288.1	779.3	251.2	32.5

Table 14.--Area of commercial forest land by forest type, stand-size class, and basal-area class, Western Upper Peninsula, Michigan, 1980

(In thousand acres)

Forest type and stand-size class	All classes	Basal area class (square feet per acre)													
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-150	151-180	181+
Jack pine															
Sawtimber	39.4	--	--	--	--	4.6	11.4	4.4	6.0	3.1	6.6	3.3	--	--	--
Poletimber	41.9	--	2.9	--	--	1.1	6.3	6.3	1.6	3.1	3.1	--	15.9	--	1.6
Sapling & seedling	7.0	1.2	--	1.2	2.4	1.8	0.4	--	--	--	--	--	--	--	--
All stands	88.3	1.2	2.9	1.2	2.4	7.5	18.1	10.7	7.6	6.2	9.7	3.3	15.9	--	1.6
Red pine															
Sawtimber	21.9	--	--	--	--	--	--	--	3.4	1.5	1.3	--	10.8	4.9	--
Poletimber	21.4	--	--	--	--	3.0	3.6	--	--	1.2	1.7	--	5.9	6.0	--
Sapling & seedling	14.3	--	--	12.4	0.4	--	1.5	--	--	--	--	--	--	--	--
All stands	57.6	--	--	12.4	0.4	3.0	5.1	--	3.4	2.7	3.0	--	16.7	10.9	--
White pine															
Sawtimber	42.0	--	--	--	1.7	--	--	1.3	5.2	--	6.6	4.7	6.5	16.0	--
Poletimber	6.7	--	--	--	--	--	--	--	3.4	1.6	1.7	--	--	--	--
Sapling & seedling	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All stands	48.7	--	--	--	1.7	--	--	1.3	8.6	1.6	8.3	4.7	6.5	16.0	--
Balsam fir															
Sawtimber	77.6	--	--	--	--	--	5.3	1.6	--	9.4	11.3	11.4	35.4	--	3.2
Poletimber	193.3	--	--	1.7	1.7	1.3	1.6	28.4	14.5	9.8	15.9	52.3	32.7	26.9	6.5
Sapling & seedling	95.7	1.4	20.5	1.5	10.9	5.5	5.9	21.9	4.8	4.1	11.3	3.3	3.2	1.4	--
All stands	366.6	1.4	20.5	3.2	12.6	6.8	12.8	51.9	19.3	23.3	38.5	67.0	71.3	28.3	9.7
White spruce															
Sawtimber	13.5	--	--	--	--	1.7	--	1.7	2.0	1.5	--	3.3	3.3	--	--
Poletimber	22.2	--	--	--	--	1.7	--	--	3.4	1.2	1.7	--	12.5	1.7	--
Sapling & seedling	4.9	--	--	1.6	--	1.7	1.6	--	--	--	--	--	--	--	--
All stands	40.6	--	--	1.6	--	5.1	1.6	1.7	5.4	2.7	1.7	3.3	15.8	1.7	--
Black spruce															
Sawtimber	7.2	--	--	--	--	--	--	--	2.3	--	--	--	4.9	--	--
Poletimber	98.1	--	--	--	2.9	3.4	9.2	3.3	1.6	6.4	13.0	23.0	21.0	5.7	8.6
Sapling & seedling	104.2	8.3	4.8	5.2	14.9	22.6	6.4	19.3	6.0	2.6	8.0	4.5	1.6	--	--
All stands	209.5	8.3	4.8	5.2	17.8	26.0	15.6	22.6	9.9	9.0	21.0	27.5	27.5	5.7	8.6
Northern white-cedar															
Sawtimber	88.3	--	--	--	--	1.6	1.4	3.9	3.0	--	6.4	25.3	15.2	15.2	16.3
Poletimber	97.1	--	--	--	--	--	--	1.3	3.6	2.9	9.3	13.1	22.0	22.5	22.4
Sapling & seedling	24.8	--	--	1.6	1.8	4.4	--	2.7	--	5.8	--	2.8	4.3	1.4	--
All stands	210.2	--	--	1.6	1.8	6.0	1.4	7.9	6.6	8.7	15.7	41.2	41.5	39.1	38.7

(Table 14 continued on next page)

(Table 14 continued)

Forest type and stand-size class	All classes	Basal area class (square feet per acre)													
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-150	151-180	181+
Tamarack															
Sawtimber	4.6	--	--	0.9	--	2.4	--	--	--	--	--	--	1.3	--	--
Poletimber	9.6	--	--	--	2.8	--	1.7	3.4	1.7	--	--	--	--	--	--
Sapling & seedling	21.8	1.8	2.3	2.3	7.6	--	--	1.6	3.0	3.2	--	--	--	--	--
All stands	36.0	1.8	2.3	3.2	10.4	2.4	1.7	5.0	4.7	3.2	--	--	1.3	--	--
Oak-hickory															
Sawtimber	11.0	--	--	--	--	--	--	--	--	3.1	3.3	1.4	--	3.2	--
Poletimber	10.0	--	--	--	--	--	--	--	--	--	--	6.7	3.3	--	--
Sapling & seedling	1.6	--	--	--	--	--	--	--	--	--	--	1.6	--	--	--
All stands	22.6	--	--	--	--	--	--	--	--	3.1	3.3	9.7	3.3	3.2	--
Elm-ash-soft maple															
Sawtimber	63.2	--	--	--	1.3	--	1.2	--	--	2.9	3.2	11.5	23.6	17.9	1.6
Poletimber	67.0	--	--	2.0	3.3	1.6	--	3.2	4.9	3.2	10.2	8.2	14.2	14.6	1.6
Sapling & seedling	39.5	3.1	4.2	--	1.3	4.9	2.9	8.2	6.7	--	6.8	1.4	--	--	--
All stands	169.7	3.1	4.2	2.0	5.9	6.5	4.1	11.4	11.6	6.1	20.2	21.1	37.8	32.5	3.2
Maple-birch															
Sawtimber	1,144.2	--	--	--	1.5	9.2	11.0	32.5	59.8	51.5	145.2	266.8	395.2	138.2	33.3
Poletimber	1,028.9	--	--	--	--	13.6	15.9	53.6	68.9	69.0	122.5	246.3	335.6	95.3	8.2
Sapling & seedling	199.3	3.6	7.9	8.5	14.4	24.0	24.7	27.6	26.4	19.8	12.7	24.9	4.8	--	--
All stands	2,372.4	3.6	7.9	8.5	15.9	46.8	51.6	113.7	155.1	140.3	280.4	538.0	735.6	233.5	41.5
Aspen															
Sawtimber	113.6	--	2.6	--	4.6	6.2	6.4	13.3	14.2	15.2	6.6	13.0	19.9	11.6	--
Poletimber	406.6	--	--	4.3	9.1	12.4	22.8	49.5	37.8	34.5	47.1	63.8	86.8	23.9	14.6
Sapling & seedling	213.1	19.8	28.8	26.0	35.0	39.5	13.9	20.8	11.6	1.6	5.3	10.8	--	--	--
All stands	733.3	19.8	31.4	30.3	48.7	58.1	43.1	83.6	63.6	51.3	59.0	87.6	106.7	35.5	14.6
Paper birch															
Sawtimber	21.1	--	--	--	1.5	--	--	--	--	1.6	1.6	8.0	6.8	--	1.6
Poletimber	101.7	--	--	--	--	1.5	3.4	1.6	6.7	6.7	9.6	14.6	47.8	9.8	--
Sapling & seedling	21.0	--	2.7	1.7	1.7	3.4	--	3.3	1.6	3.3	--	3.3	--	--	--
All stands	143.8	--	2.7	1.7	3.2	4.9	3.4	4.9	8.3	11.6	11.2	25.9	54.6	9.8	1.6
Exotic															
Sawtimber	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Poletimber	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sapling & seedling	1.6	--	--	--	1.6	--	--	--	--	--	--	--	--	--	--
All stands	1.6	--	--	--	1.6	--	--	--	--	--	--	--	--	--	--
Nonstocked	28.7	14.9	13.8	--	--	--	--	--	--	--	--	--	--	--	--
All types															
Sawtimber	1,647.6	--	2.6	0.9	10.6	25.7	36.7	58.7	95.9	89.8	192.1	348.7	522.9	207.0	56.0
Poletimber	2,104.5	--	2.9	8.0	19.8	39.6	64.5	150.6	148.1	139.6	235.8	428.0	597.7	206.4	63.5
Sapling & seedling	748.8	39.2	71.2	62.0	92.0	107.8	57.3	105.4	60.1	40.4	44.1	52.6	13.9	2.8	--
Nonstocked	28.7	14.9	13.8	--	--	--	--	--	--	--	--	--	--	--	--
All stands	4,529.6	54.1	90.5	70.9	122.4	173.1	158.5	314.7	304.1	269.8	472.0	829.3	1,134.5	416.2	119.5

Table 15.--Area of commercial forest land by stocking class of growing-stock trees and stand-size class, Western Upper Peninsula, Michigan, 1980

(In thousand acres)

Stocking class (percent)	All stands	Stand-size class			
		Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
Less than 16.7	28.7	--	--	--	28.7
16.7 to 60.9	242.1	58.9	83.9	99.3	--
61.0 to 100.9	1,558.9	553.7	692.4	312.8	--
101.0 to 133.9	2,223.2	828.2	1,128.4	266.6	--
134.0 or more	476.7	206.8	199.8	70.1	--
All classes	4,529.6	1,647.6	2,104.5	748.8	28.7

Table 16.--Area of commercial forest land by stocking class based on selected stand components, Western Upper Peninsula, Michigan, 1980

(In thousand acres)

Stocking class (percent)	Stocking classified in terms of				
	All live trees	Growing-stock trees	Desirable trees	Acceptable trees	Rough and rotten trees
0-10	2.9	15.4	4,384.4	15.4	1,936.9
11-20	7.8	24.5	108.1	24.5	1,401.2
21-30	20.1	37.6	24.7	39.2	763.8
31-40	21.4	30.2	10.8	30.2	286.5
41-50	42.3	71.4	--	78.1	95.6
51-60	62.0	92.0	1.6	119.9	27.7
61-70	75.3	228.3	--	222.0	9.7
71-80	149.1	293.4	--	302.1	1.6
81-90	256.5	460.6	--	499.2	2.6
91-100	325.8	576.7	--	629.4	1.5
101-110	479.6	737.1	--	739.8	--
111-120	652.7	718.7	--	697.0	1.2
121-130	835.0	637.2	--	639.8	1.3
131-140	745.7	394.7	--	316.1	--
141-150	610.7	169.1	--	143.6	--
151-160	234.0	42.7	--	33.3	--
161+	8.7	--	--	--	--
Total	4,529.6	4,529.6	4,529.6	4,529.6	4,529.6

Table 17.--Area of noncommercial forest land by ownership class, Western Upper Peninsula, Michigan, 1980

(In thousand acres)

Ownership class	All areas	Productive-reserved areas	Unproductive areas
National Forest	65.5	45.6[1/]	19.9
Bureau of Land Management	--	--	--
Indian	--	--	--
Miscellaneous federal	125.9	125.9	--
State	105.1	95.0	10.1
County and municipal	0.2	0.2	--
Forest industry	16.9	--	16.9
Farmer	0.2	--	0.2
Misc. private-corp.	7.8	--	7.8
Misc. private-indiv.	7.3	--	7.3
Total	328.9	266.7	62.2

[1/] Includes 22.9 thousand acres of productive-deferred.

Table 18.--Area of noncommercial forest land by forest type, Western Upper Peninsula, Michigan, 1980

(In thousand acres)

Forest type	All areas	Productive-reserved areas[1/]	Unproductive areas
Jack pine	6.9	6.8	0.1
Red pine	3.1	1.4	1.7
White pine	1.2	1.2	--
Balsam fir	52.1	49.6	2.5
White spruce	6.3	5.3	1.0
Black spruce	27.1	14.0	13.1
Northern white-cedar	17.3	0.1	17.2
Tamarack	5.7	--	5.7
Oak-hickory	--	--	--
Elm-ash-soft maple	4.6	4.3	0.3
Maple-birch	110.8	108.7	2.1
Aspen	74.4	72.8	1.6
Paper birch	1.5	1.5	--
Exotic	--	--	--
Nonstocked	17.9	1.0	16.9
All types	328.9	266.7	62.2

[1/] Includes 22.9 thousand acres of productive-deferred.

Table 19.--Area of nonforest land with trees by forest type and land use, Western Upper Peninsula, Michigan, 1980

(In thousand acres)

Forest type	All uses	Land use							
		Cropland	Improved pasture	Wooded strips	Idle farmland	Marsh	Wind-breaks	Urban and other windbreaks	Wooded pasture
Jack pine	1.7	--	1.7	--	--	--	--	--	--
Red pine	--	--	--	--	--	--	--	--	--
White pine	--	--	--	--	--	--	--	--	--
Balsam fir	--	--	--	--	--	--	--	--	--
White spruce	--	--	--	--	--	--	--	--	--
Black spruce	1.6	--	--	--	--	1.6	--	--	--
Northern white-cedar	6.0	--	--	--	--	6.0	--	--	--
Tamarack	--	--	--	--	--	--	--	--	--
Oak-hickory	--	--	--	--	--	--	--	--	--
Elm-ash-soft maple	4.3	1.8	--	--	--	2.5	--	--	--
Maple-birch	7.2	--	7.2	--	--	--	--	--	--
Aspen	12.3	1.8	3.7	--	--	5.1	--	--	1.7
Paper birch	--	--	--	--	--	--	--	--	--
Exotic	--	--	--	--	--	--	--	--	--
All types	33.1	3.6	12.6	--	--	15.2	--	--	1.7

Table 20.--Number of all live trees on commercial forest land by species group and diameter class, Western Upper Peninsula, Michigan, 1980

(In thousand trees)

Species group	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS															
White pine	15,099	4,368	1,638	2,197	1,524	1,420	968	1,073	636	553	238	250	210	24	--
Red pine	28,766	12,217	7,226	4,203	2,643	842	629	459	285	120	109	17	16	--	--
Jack pine	28,892	5,208	5,990	7,385	5,661	2,862	1,147	428	181	25	3	2	--	--	--
White spruce	68,038	26,015	18,109	9,528	6,143	3,985	2,044	1,266	621	224	69	16	18	--	--
Black spruce	131,983	55,599	41,264	24,674	7,951	1,840	468	132	45	7	3	--	--	--	--
Balsam fir	556,092	315,682	142,925	61,734	24,285	8,344	2,505	459	143	10	--	--	5	--	--
Hemlock	47,924	13,227	7,638	5,375	4,998	4,845	4,380	3,127	2,108	1,058	594	331	217	26	--
Tamarack	25,222	9,304	8,547	4,570	1,763	756	133	82	57	6	2	2	--	--	--
Northern white-cedar	166,404	54,962	42,119	30,567	17,396	9,905	5,784	2,899	1,464	692	275	190	139	12	--
Other softwoods	1,688	1,602	--	45	29	--	7	--	5	--	--	--	--	--	--
Total	1,070,108	498,184	275,456	150,278	72,393	34,799	18,065	9,925	5,545	2,695	1,293	808	605	62	--
HARDWOODS															
Select white oaks	79	--	--	--	--	34	23	22	--	--	--	--	--	--	--
Select red oaks	16,523	4,255	3,703	2,446	1,940	1,647	978	787	402	191	89	45	36	4	--
Other red oaks	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yellow birch	132,595	58,861	28,130	17,125	11,200	6,381	3,669	2,800	1,810	1,063	650	361	425	109	11
Hard maple	983,864	578,735	210,288	94,658	46,726	23,570	11,842	7,317	4,977	3,001	1,451	591	613	95	--
Soft maple	401,474	193,852	98,548	54,010	29,205	13,313	6,389	3,171	1,696	698	312	134	132	13	1
Beech	413	324	--	31	38	--	11	--	9	--	--	--	--	--	--
Ash	132,737	82,070	28,868	11,033	5,337	2,681	1,564	731	307	104	27	13	2	--	--
Balsam poplar	17,732	8,888	2,921	2,184	1,420	965	664	362	163	82	46	21	13	3	--
Cottonwood	4	--	--	--	--	--	--	--	4	--	--	--	--	--	--
Bigtooth aspen	21,582	4,898	3,168	4,282	4,280	2,409	1,390	700	256	117	32	34	16	--	--
Quaking aspen	256,110	130,212	37,748	30,318	25,596	16,917	9,077	3,785	1,599	576	209	54	15	4	--
Basswood	50,040	11,369	11,102	10,153	8,221	4,696	2,429	1,052	573	250	120	47	24	4	--
Yellow-poplar	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Black cherry	38,444	19,089	7,940	5,307	3,580	1,653	521	265	47	27	15	--	--	--	--
Butternut	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Elm	52,103	21,240	11,977	7,592	5,004	2,737	1,701	995	386	222	142	45	40	21	1
Paper birch	90,126	25,150	20,527	18,823	13,986	7,039	3,050	953	388	124	44	26	12	4	--
Other hardwoods	1,046	760	162	37	27	9	23	10	18	--	--	--	--	--	--
Noncommercial species	126,971	95,271	22,764	6,182	1,899	623	142	71	4	4	11	--	--	--	--
Total	2,321,843	1,234,974	487,846	264,181	158,459	84,674	43,473	23,021	12,639	6,459	3,148	1,371	1,328	257	13
All species	3,391,951	1,733,158	763,302	414,459	230,852	119,473	61,538	32,946	18,184	9,154	4,441	2,179	1,933	319	13

Table 21.--Number of growing-stock trees on commercial forest land by species group and diameter class, Western Upper Peninsula, Michigan, 1980

(In thousand trees)

Species group	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS															
White pine	14,240	4,160	1,638	1,876	1,433	1,306	921	1,031	631	547	233	250	192	22	--
Red pine	28,646	12,218	7,227	4,202	2,557	827	614	459	285	117	109	15	16	--	--
Jack pine	28,214	4,897	5,990	7,273	5,586	2,769	1,097	412	167	18	3	2	--	--	--
White spruce	67,117	25,857	17,824	9,399	5,989	3,884	2,013	1,211	621	216	69	16	18	--	--
Black spruce	130,461	55,083	40,861	24,321	7,727	1,820	461	133	45	7	3	--	--	--	--
Balsam fir	543,406	307,881	140,893	59,893	23,663	8,053	2,440	440	134	4	--	--	5	--	--
Hemlock	43,151	13,227	7,317	4,193	4,022	3,900	3,686	2,805	1,960	967	551	289	210	24	--
Tamarack	24,155	8,974	8,547	4,198	1,480	703	119	71	53	6	2	2	--	--	--
Northern white-cedar	146,137	52,044	38,741	26,041	13,567	7,348	4,406	2,103	1,055	448	190	116	70	8	--
Other softwoods	1,523	1,442	--	45	29	--	7	--	--	--	--	--	--	--	--
Total	1,027,050	485,783	269,038	141,441	66,053	30,610	15,764	8,665	4,951	2,330	1,160	690	511	54	--
HARDWOODS															
Select white oaks	46	--	--	--	--	--	24	22	--	--	--	--	--	--	--
Select red oaks	15,464	4,255	3,371	2,080	1,872	1,535	928	740	376	178	57	39	31	2	--
Other red oaks	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yellow birch	111,404	52,308	24,599	13,048	8,885	4,884	2,647	2,155	1,294	763	398	204	179	32	8
Hard maple	902,767	534,214	195,095	85,732	41,339	20,460	9,956	6,535	4,482	2,646	1,278	502	457	71	--
Soft maple	370,995	180,827	92,764	49,338	26,465	11,415	5,179	2,648	1,410	535	243	96	65	10	--
Beech	393	323	--	31	34	--	--	--	5	--	--	--	--	--	--
Ash	125,112	77,228	28,013	10,285	4,705	2,387	1,443	662	253	94	27	13	2	--	--
Balsam poplar	17,196	8,684	2,921	2,035	1,361	901	627	345	159	79	46	21	14	3	--
Cottonwood	4	--	--	--	--	--	--	--	4	--	--	--	--	--	--
Bigtooth aspen	18,635	4,256	2,667	3,739	3,670	2,183	1,195	581	215	86	14	19	10	--	--
Quaking aspen	231,452	120,828	34,764	26,435	22,651	14,448	7,541	3,058	1,123	439	130	23	8	4	--
Basswood	45,055	9,722	10,123	9,027	7,761	4,347	2,212	959	517	232	103	30	19	3	--
Yellow-poplar	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Black cherry	31,618	16,987	5,658	4,042	3,031	1,312	304	218	43	13	10	--	--	--	--
Butternut	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Elm	46,223	17,594	11,017	7,214	4,649	2,562	1,514	895	363	199	128	40	32	15	1
Paper birch	82,345	24,049	17,930	17,122	12,875	6,379	2,707	836	323	75	25	14	10	--	--
Other hardwoods	205	--	162	37	--	--	6	--	--	--	--	--	--	--	--
Total	1,998,914	1,051,275	429,084	230,165	139,298	72,813	36,283	19,654	10,567	5,339	2,459	1,001	827	140	9
All species	3,025,964	1,537,058	698,122	371,606	205,351	103,423	52,047	28,319	15,518	7,669	3,619	1,691	1,338	194	9

Table 22.--Number of short-log trees on commercial forest land by species group and diameter class, Western Upper Peninsula, Michigan, 1980

(In thousand trees)

Species group	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS											
White pine	77	42	14	6	--	6	3	--	6	--	--
Red pine	16	--	16	--	--	--	--	--	--	--	--
Jack pine	88	51	26	4	--	7	--	--	--	--	--
White spruce	119	78	16	21	--	4	--	--	--	--	--
Black spruce	--	--	--	--	--	--	--	--	--	--	--
Balsam fir	154	93	48	7	--	6	--	--	--	--	--
Hemlock	827	438	190	85	37	38	14	20	4	1	--
Tamarack	3	--	--	--	3	--	--	--	--	--	--
Northern white-cedar	1,301	522	414	131	127	38	25	22	21	1	--
Other softwoods	--	--	--	--	--	--	--	--	--	--	--
Total	2,585	1,224	724	254	167	99	42	42	31	2	--
HARDWOODS											
Select white oaks	--	--	--	--	--	--	--	--	--	--	--
Select red oaks	94	--	24	24	17	3	17	4	5	--	--
Other red oaks	--	--	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--	--	--
Yellow birch	941	--	303	192	174	66	88	39	54	25	--
Hard maple	1,410	--	599	306	209	127	63	33	61	12	--
Soft maple	789	--	391	187	88	51	27	14	30	1	--
Beech	13	--	9	--	4	--	--	--	--	--	--
Ash	76	--	55	12	9	--	--	--	--	--	--
Balsam poplar	29	--	25	--	4	--	--	--	--	--	--
Cottonwood	--	--	--	--	--	--	--	--	--	--	--
Bigtooth aspen	186	--	98	60	10	10	6	2	--	--	--
Quaking aspen	792	--	413	175	134	44	21	5	--	--	--
Basswood	165	--	93	17	27	7	10	8	2	1	--
Yellow-poplar	--	--	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--	--	--
Black cherry	118	--	88	17	--	13	--	--	--	--	--
Butternut	--	--	--	--	--	--	--	--	--	--	--
Elm	241	--	161	50	4	17	6	--	3	--	--
Paper birch	275	--	186	29	23	18	11	7	--	1	--
Other hardwoods	5	--	--	5	--	--	--	--	--	--	--
Total	5,134	--	2,445	1,074	703	356	249	112	155	40	--
All species	7,719	1,224	3,169	1,328	870	455	291	154	186	42	--

Table 23.--Net volume of growing stock on commercial forest land by species group, Western Upper Peninsula, Michigan, 1966 and 1980

(In million cubic feet)

Species group	1966	1980
SOFTWOODS		
White pine	141.0	153.8
Red pine	42.4	73.7
Jack pine	63.6	104.8
White spruce	142.1	207.6
Black spruce	128.2	136.5
Balsam fir	328.4	405.5
Hemlock	287.5	281.5
Tamarack	21.2	34.9
Northern white-cedar	272.8	330.1
Other softwoods	--	0.3
Total	1,427.2	1,728.7
HARDWOODS		
Select white oak	--	0.8
Select red oak	101.1	85.1
Other red oak	--	--
Hickory	--	--
Yellow birch	340.3	321.6
Hard maple	1,210.5	1,404.7
Soft maple	361.1	628.5
Beech	0.6	0.5
Ash	104.8	130.8
Balsam poplar	18.5	42.8
Cottonwood	--	0.1
Bigtooth aspen	85.2	104.5
Quaking aspen	630.1	643.0
Basswood	113.1	209.2
Yellow-poplar	--	--
Black walnut	--	--
Black cherry	38.4	53.6
Butternut	--	--
Elm	144.8	148.2
Paper birch	177.1	282.8
Other hardwoods	4.3	0.2
Total	3,329.9	4,056.4
All species	4,757.1	5,785.1

Table 24.--Net volume of all live trees on commercial forest land by species group and diameter class, Western Upper Peninsula, Michigan, 1980

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS													
White pine	157,521	4,509	7,030	12,288	12,763	22,782	19,534	23,158	12,510	17,779	20,493	4,675	--
Red pine	74,360	10,435	13,234	7,817	9,657	11,090	9,185	4,916	5,673	1,065	1,288	--	--
Jack pine	106,727	19,553	31,125	26,247	15,791	8,252	4,771	773	107	108	--	--	--
White spruce	210,118	25,110	35,472	42,126	34,863	32,283	22,083	10,625	4,244	1,282	2,030	--	--
Black spruce	137,774	63,551	42,541	18,188	7,782	3,501	1,644	347	220	--	--	--	--
Balsam fir	413,139	147,919	130,316	80,869	38,207	10,489	4,193	402	--	--	744	--	--
Hemlock	304,366	9,166	19,553	32,997	46,922	50,257	49,013	33,518	25,669	16,868	16,825	3,578	--
Tamarack	36,450	12,276	10,092	8,323	2,244	1,713	1,499	172	68	63	--	--	--
Northern white-cedar	384,992	64,630	71,459	67,155	62,274	43,193	30,923	18,300	9,920	7,934	7,898	1,306	--
Other softwoods	388	77	140	--	119	--	52	--	--	--	--	--	--
Total	1,825,835	357,226	360,962	296,010	230,622	183,560	142,897	92,211	58,411	45,099	49,278	9,559	--
HARDWOODS													
Select white oaks	1,138	--	--	369	382	387	--	--	--	--	--	--	--
Select red oaks	90,588	6,153	10,520	15,634	14,382	16,328	11,413	6,880	3,690	2,554	2,571	463	--
Other red oaks	--	--	--	--	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--	--	--	--	--
Yellow birch	402,763	40,911	56,324	52,682	45,561	50,721	43,705	33,612	25,003	16,385	25,171	9,713	2,975
Hard maple	1,538,043	260,965	266,792	231,844	180,893	159,865	148,034	117,375	71,798	34,552	51,655	14,270	--
Soft maple	696,070	146,596	166,240	128,885	93,091	65,458	45,722	22,567	12,836	6,166	7,112	1,327	70
Beech	735	106	270	--	114	--	245	--	--	--	--	--	--
Ash	138,691	29,888	29,715	25,602	23,144	15,563	8,292	3,879	1,412	1,025	171	--	--
Balsam poplar	43,805	3,062	5,179	6,362	8,149	6,919	4,482	3,192	2,543	1,668	1,500	749	--
Cottonwood	73	--	--	--	--	--	73	--	--	--	--	--	--
Bigtooth aspen	115,419	12,872	26,277	25,069	21,230	14,904	7,258	4,079	1,197	1,637	896	--	--
Quaking aspen	717,089	90,935	157,303	174,059	139,386	79,855	42,380	20,695	8,852	2,143	1,016	465	--
Basswood	220,812	27,023	48,302	47,719	37,611	22,482	17,000	9,962	5,643	2,489	1,817	764	--
Yellow-poplar	--	--	--	--	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--	--	--	--	--
Black cherry	63,374	12,876	19,775	15,800	7,050	5,227	1,301	843	502	--	--	--	--
Butternut	--	--	--	--	--	--	--	--	--	--	--	--	--
Elm	158,421	21,902	29,464	27,030	25,799	20,966	10,836	7,811	6,681	2,436	3,127	2,253	116
Paper birch	305,370	64,164	88,148	72,505	45,240	18,896	9,595	3,456	1,521	1,113	619	113	--
Other hardwoods	950	110	78	55	192	153	362	--	--	--	--	--	--
Noncommercial species	30,668	13,823	8,456	4,742	1,697	1,260	88	125	477	--	--	--	--
Total	4,524,009	731,386	912,843	828,357	643,921	478,984	350,786	234,476	142,155	72,168	95,655	30,117	3,161
All species	6,349,844	1,088,612	1,273,805	1,124,367	874,543	662,544	493,683	326,687	200,566	117,267	144,933	39,676	3,161

Table 25.--Net volume of timber on commercial forest land by class of timber and softwoods and hardwoods, Western Upper Peninsula, Michigan, 1980

(In thousand cubic feet)

Class of timber	All species	Softwoods	Hardwoods
LIVE TREES			
Growing-stock trees			
Sawtimber			
Saw log portion	2,492,966	917,175	1,575,791
Upper stem portion	347,064	119,846	227,218
Subtotal	2,840,030	1,037,021	1,803,009
Poletimber	2,945,001	691,648	2,253,353
Total growing-stock	5,785,031	1,728,669	4,056,362
Cull trees			
Rough and rotten cull trees			
Sawtimber	195,661	44,523	151,138
Poletimber	245,774	26,541	219,233
Subtotal	441,435	71,064	370,371
Short-log cull trees	123,378	26,102	97,276
Total cull	564,813	97,166	467,647
TOTAL LIVE TREES	6,349,844	1,825,835	4,524,009
SALVABLE DEAD TREES	198,420	85,740	112,680
ALL CLASSES	6,548,264	1,911,575	4,636,689

Table 26.--Net volume of growing-stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species, Western Upper Peninsula, Michigan, 1980

Species	Total all live	Growing stock	Short-log cull	Rough and rotten cull	Sawtimber
	Thousand cubic feet				Thousand board feet 1/
SOFTWOODS					
White pine	157,521	153,771	1,014	2,736	780,033
Red pine	74,360	73,688	143	529	279,874
Jack pine	106,727	104,739	833	1,155	276,692
Scotch pine	--	--	--	--	--
White spruce	210,118	207,633	992	1,493	745,345
Norway spruce	217	217	--	--	--
Engelmann spruce	--	--	--	--	--
Black spruce	137,774	136,530	--	1,244	153,343
Balsam fir	413,139	405,475	1,289	6,375	610,899
Hemlock	304,366	281,531	8,360	14,475	1,444,202
Tamarack	36,450	34,916	60	1,474	61,261
Northern white-cedar	384,992	330,049	13,411	41,532	994,377
Eastern redcedar	171	120	--	51	589
Total	1,825,835	1,728,669	26,102	71,064	5,346,615
HARDWOODS					
White oak	--	--	--	--	--
Bur oak	1,138	769	--	369	3,693
Swamp white oak	--	--	--	--	--
Northern red oak	90,588	85,076	2,266	3,246	298,531
Shellbark hickory	--	--	--	--	--
Yellow birch	402,763	321,572	21,050	60,141	1,049,376
Black maple	116	116	--	--	--
Sugar maple	1,537,927	1,404,594	31,141	102,192	4,009,886
Red maple	693,953	626,833	13,450	53,670	1,160,841
Silver maple	2,117	1,676	143	298	7,868
American beech	735	488	202	45	821
White ash	31,279	30,163	475	641	68,007
Black ash	104,440	97,878	587	5,975	200,287
Green ash	2,972	2,749	--	223	10,030
Balsam poplar	43,805	42,799	392	614	153,205
Paper birch	305,370	282,834	3,969	18,567	376,599
Bigtooth aspen	115,419	104,484	2,568	8,367	242,428
Quaking aspen	717,089	643,017	12,396	61,676	1,360,347
Basswood	220,812	209,228	3,042	8,542	505,144
American elm	156,938	146,695	3,832	6,411	391,201
Slippery elm	1,199	1,199	--	--	3,569
Rock elm	284	284	--	--	1,555
Black cherry	63,374	53,658	1,706	8,010	55,406
Boxelder	853	177	57	619	432
Sweet birch	--	--	--	--	--
Eastern cottonwood	73	73	--	--	371
Black willow	97	--	--	97	--
Ohio buckeye	--	--	--	--	--
Flowering dogwood	--	--	--	--	--
Black locust	--	--	--	--	--
Noncommercial species	30,668	--	--	30,668	--
Total	4,524,009	4,056,362	97,276	370,371	9,899,597
All species	6,349,844	5,785,031	123,378	441,435	15,246,212

1/ International 1/4-inch rule.

Table 27.--Net volume of noncommercial species (nongrowing-stock volume) on commercial forest land by individual species, Western Upper Peninsula, Michigan, 1980

(In thousand cubic feet)

Species	Nongrowing-stock (rough tree) volume
Striped maple	681
Mountain maple	2,240
Ailanthus	--
American hornbeam	114
Eastern hophornbeam	24,888
Eastern redbud	--
Hawthorn	--
Apple	121
Pin cherry	704
Chokecherry	716
Mountain ash	1,204
Peachleaf willow	--
Diamond willow	--
All species	30,668

Table 28.--Net volume of growing stock on commercial forest land by county and species group, Western Upper Peninsula, Michigan, 1980

(In thousand cubic feet)

Species group	All counties	County							
		Baraga	Dickinson	Gogebic	Houghton	Iron	Keweenaw	Marquette	Ontonagon
SOFTWOODS									
White pine	153,771	11,690	7,961	6,184	11,644	27,923	13,780	57,551	17,038
Red pine	73,688	3,531	5,135	7,845	11,032	9,427	474	26,769	9,475
Jack pine	104,739	6,425	1,508	6,375	17,715	7,988	--	54,887	9,841
White spruce	207,633	23,514	12,721	23,665	17,357	35,308	12,968	44,848	37,252
Black spruce	136,530	17,149	16,388	14,777	6,174	27,640	5,791	43,826	4,785
Balsam fir	405,475	41,352	35,583	59,181	36,395	72,293	22,172	87,209	51,290
Hemlock	281,531	58,700	1,641	49,862	32,689	23,276	274	69,212	45,877
Tamarack	34,916	4,296	4,784	3,243	3,498	10,290	397	7,599	809
Northern white-cedar	330,049	43,425	40,428	40,629	28,043	25,712	49,271	78,037	24,504
Other softwoods	337	--	--	158	24	27	--	77	51
Total	1,728,669	210,082	126,149	211,919	164,571	239,884	105,127	470,015	200,922
HARDWOODS									
Select white oaks	769	50	--	167	92	77	--	--	383
Select red oaks	85,076	3,140	4,423	6,543	10,178	6,277	17,007	33,636	3,872
Other red oaks	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--
Yellow birch	321,572	65,784	5,852	51,438	51,616	35,135	15,604	50,800	45,343
Hard maple	1,404,710	209,963	58,492	199,816	223,250	185,935	62,350	268,226	196,678
Soft maple	628,509	112,115	13,579	60,607	102,832	54,797	38,908	164,385	81,286
Beech	488	--	--	--	--	--	--	488	--
Ash	130,790	12,967	8,468	38,200	13,234	8,710	1,393	10,946	36,872
Balsam poplar	42,799	2,650	20,809	210	353	6,693	460	7,346	4,278
Cottonwood	73	--	--	--	--	73	--	--	--
Bigtooth aspen	104,484	8,724	8,524	7,723	9,823	14,549	674	39,162	15,305
Quaking aspen	643,017	37,744	63,209	88,450	74,034	107,243	18,749	90,446	163,142
Basswood	209,228	8,365	30,521	40,106	25,313	30,737	1,388	18,844	53,954
Yellow-poplar	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--
Black cherry	53,658	11,354	2,549	9,010	4,656	11,589	150	10,305	4,045
Butternut	--	--	--	--	--	--	--	--	--
Elm	148,178	10,152	12,947	32,884	16,139	29,633	925	12,025	33,473
Paper birch	282,834	25,958	27,995	16,807	22,090	54,642	29,640	87,841	17,861
Other hardwoods	177	--	--	110	--	--	--	--	67
Total	4,056,362	508,966	257,368	552,071	553,610	546,090	187,248	794,450	656,559
All species	5,785,031	719,048	383,517	763,990	718,181	785,974	292,375	1,264,465	857,481

Table 29.--Net volume of sawtimber on commercial forest land by county and species group, Western Upper Peninsula, Michigan, 1980

(In thousand board feet)[1/]

Species group	All counties	County							
		Baraga	Dickinson	Gogebic	Houghton	Iron	Keweenaw	Marquette	Ontonagon
SOFTWOODS									
White pine	780,033	62,081	39,185	31,809	60,937	140,182	72,749	286,654	86,436
Red pine	279,874	19,026	20,152	15,209	42,026	33,862	1,086	128,220	20,293
Jack pine	276,692	8,047	3,475	10,655	32,334	19,407	--	186,395	16,379
White spruce	745,345	92,445	42,080	91,333	59,238	132,524	47,743	156,655	123,327
Black spruce	153,343	19,405	11,519	17,879	8,868	31,630	13,468	45,076	5,498
Balsam fir	610,899	58,749	50,341	81,480	63,311	114,526	36,258	124,556	81,678
Hemlock	1,444,202	310,370	7,789	248,181	166,553	124,563	1,487	357,652	227,607
Tamarack	61,261	10,223	2,303	5,362	10,223	21,647	1,083	9,234	1,186
Northern white-cedar	994,377	163,114	69,513	136,366	101,157	77,832	155,233	204,497	86,665
Other softwoods	589	--	--	589	--	--	--	--	--
Total	5,346,615	743,460	246,357	638,863	544,647	696,173	329,107	1,498,939	649,069
HARDWOODS									
Select white oaks	3,693	241	--	803	440	371	--	--	1,838
Select red oaks	298,531	9,500	18,140	19,398	41,323	20,547	70,995	105,533	13,095
Other red oaks	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--
Yellow birch	1,049,376	247,536	12,036	148,891	141,970	120,608	59,976	195,806	122,553
Hard maple	4,009,886	700,785	67,583	535,635	664,036	499,633	171,170	781,680	589,364
Soft maple	1,168,709	264,384	12,024	108,544	198,769	115,743	87,305	266,336	115,604
Beech	821	--	--	--	--	--	--	821	--
Ash	278,324	34,684	12,310	86,351	26,589	16,842	3,503	19,504	78,541
Balsam poplar	153,205	12,451	78,033	1,261	1,201	16,018	--	24,278	19,963
Cottonwood	371	--	--	--	--	371	--	--	--
Bigtooth aspen	242,428	27,062	22,346	21,943	25,895	33,967	1,407	78,829	30,979
Quaking aspen	1,360,347	97,251	101,347	180,969	195,197	217,565	44,873	186,731	336,414
Basswood	505,144	25,304	79,143	74,694	71,722	59,520	5,958	75,179	113,624
Yellow-poplar	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--
Black cherry	55,406	11,334	2,469	8,175	6,779	10,468	--	11,359	4,822
Butternut	--	--	--	--	--	--	--	--	--
Elm	396,325	30,081	28,820	83,238	50,395	79,819	4,979	37,621	81,372
Paper birch	376,599	49,697	18,345	17,759	26,263	69,993	51,580	123,692	19,270
Other hardwoods	432	--	--	--	--	--	--	--	432
Total	9,899,597	1,510,310	452,596	1,287,661	1,450,579	1,261,465	501,746	1,907,369	1,527,871
All species	15,246,212	2,253,770	698,953	1,926,524	1,995,226	1,957,638	830,853	3,406,308	2,176,940

[1/]International 1/4-inch rule.

Table 30.--Net volume of growing stock on commercial forest land by species group and diameter class, Western Upper Peninsula, Michigan, 1980

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS													
White pine	153,771	3,872	6,767	11,567	12,403	22,356	19,492	22,995	12,373	17,779	19,801	4,366	--
Red pine	73,688	10,434	12,897	7,754	9,514	11,090	9,186	4,855	5,673	997	1,288	--	--
Jack pine	104,739	19,369	30,918	25,692	15,317	8,083	4,559	586	107	108	--	--	--
White spruce	207,633	24,911	35,020	41,507	34,656	31,390	22,082	10,511	4,244	1,282	2,030	--	--
Black spruce	136,530	63,104	41,867	18,136	7,711	3,501	1,644	347	220	--	--	--	--
Balsam fir	405,475	144,988	128,220	79,214	37,742	10,300	4,081	186	--	--	744	--	--
Hemlock	281,531	7,755	16,691	28,285	42,599	47,354	47,015	31,681	24,546	15,844	16,436	3,325	--
Tamarack	34,916	11,801	9,561	8,115	2,147	1,550	1,438	172	68	64	--	--	--
Northern white-cedar	330,049	60,142	63,114	57,813	53,724	36,459	25,674	13,827	7,908	5,717	4,761	910	--
Other softwoods	337	77	140	--	120	--	--	--	--	--	--	--	--
Total	1,728,669	346,453	345,195	278,083	215,933	172,083	135,171	85,160	55,139	41,791	45,060	8,601	--
HARDWOODS													
Select white oaks	769	--	--	--	382	387	--	--	--	--	--	--	--
Select red oaks	85,076	5,417	10,199	14,987	13,998	15,710	10,890	6,547	2,600	2,255	2,253	220	--
Other red oaks	--	--	--	--	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--	--	--	--	--
Yellow birch	321,572	36,081	48,972	44,625	36,799	42,906	34,719	27,245	18,155	11,311	14,162	4,026	2,571
Hard maple	1,404,710	242,846	244,189	210,180	160,430	148,042	138,458	108,258	66,264	30,985	43,569	11,489	--
Soft maple	628,509	137,322	155,211	116,081	80,818	58,293	40,455	19,031	11,024	5,068	4,103	1,103	--
Beech	488	106	243	--	--	--	139	--	--	--	--	--	--
Ash	130,790	28,643	27,275	23,866	22,030	14,873	7,799	3,696	1,412	1,025	171	--	--
Balsam poplar	42,799	2,960	5,149	6,180	7,769	6,749	4,393	3,138	2,543	1,669	1,500	749	--
Cottonwood	73	--	--	--	--	--	73	--	--	--	--	--	--
Bigtooth aspen	104,484	12,083	23,429	23,931	19,429	13,414	6,555	3,332	628	1,054	629	--	--
Quaking aspen	643,017	83,633	144,812	159,521	124,415	69,933	34,157	17,543	6,519	1,406	613	465	--
Basswood	209,228	24,961	46,858	45,752	35,487	21,555	16,089	9,633	5,163	1,743	1,499	488	--
Yellow-poplar	--	--	--	--	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--	--	--	--	--
Black cherry	53,658	10,952	17,501	13,665	4,843	4,583	1,202	472	440	--	--	--	--
Butternut	--	--	--	--	--	--	--	--	--	--	--	--	--
Elm	148,178	21,176	28,106	25,556	23,587	19,373	10,427	7,178	6,152	2,264	2,608	1,634	117
Paper birch	282,834	60,269	83,065	67,441	41,216	17,258	8,634	2,569	1,077	711	594	--	--
Other hardwoods	177	110	--	--	67	--	--	--	--	--	--	--	--
Total	4,056,362	666,559	835,009	751,785	571,270	433,076	313,990	208,642	121,977	59,491	71,701	20,174	2,688
All species	5,785,031	1,013,012	1,180,204	1,029,868	787,203	605,159	449,161	293,802	177,116	101,282	116,761	28,775	2,688

Table 31.--Net volume of sawtimber on commercial forest land by species group and diameter class, Western Upper Peninsula, Michigan, 1980

(In thousand board feet)[1/]

Species group	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS											
White pine	780,033	59,608	64,824	116,312	105,973	123,838	68,608	101,472	113,220	26,178	--
Red pine	279,874	41,996	52,007	60,280	51,325	27,802	32,496	6,002	7,966	--	--
Jack pine	276,692	129,774	76,755	41,758	24,183	3,076	574	572	--	--	--
White spruce	745,345	205,601	172,609	157,331	113,341	55,384	22,434	7,135	11,510	--	--
Black spruce	153,343	84,525	37,973	18,448	9,119	1,964	1,314	--	--	--	--
Balsam fir	610,899	355,378	178,094	51,283	20,680	1,036	--	--	4,428	--	--
Hemlock	1,444,202	157,263	237,255	262,130	265,476	178,485	138,342	90,312	96,149	18,790	--
Tamarack	61,261	34,635	10,368	7,990	7,032	708	265	263	--	--	--
Northern white-cedar	994,377	270,683	255,108	174,601	126,350	68,993	39,731	29,179	24,903	4,829	--
Other softwoods	589	--	589	--	--	--	--	--	--	--	--
Total	5,346,615	1,339,463	1,085,582	890,133	723,479	461,286	303,764	234,935	258,176	49,797	--
HARDWOODS											
Select white oaks	3,693	--	1,952	1,741	--	--	--	--	--	--	--
Select red oaks	298,531	--	71,942	85,441	61,213	37,711	15,415	13,180	12,491	1,138	--
Other red oaks	--	--	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--	--	--
Yellow birch	1,049,376	--	200,164	237,069	196,088	154,491	98,245	63,259	72,589	17,555	9,916
Hard maple	4,009,886	--	827,290	837,783	814,185	649,648	394,526	182,032	243,019	61,403	--
Soft maple	1,168,709	--	384,016	318,763	233,475	113,072	64,724	28,086	21,122	5,451	--
Beech	821	--	--	--	821	--	--	--	--	--	--
Ash	278,324	--	116,256	81,966	43,598	21,422	7,989	6,000	1,093	--	--
Balsam poplar	153,205	--	42,823	37,268	23,748	16,740	13,600	8,331	7,220	3,475	--
Cottonwood	371	--	--	--	371	--	--	--	--	--	--
Bigtooth aspen	242,428	--	100,040	72,901	37,719	19,185	3,520	5,714	3,349	--	--
Quaking aspen	1,360,347	--	650,303	377,906	186,264	95,702	37,148	7,603	3,207	2,214	--
Basswood	505,144	--	181,894	121,048	95,157	56,295	29,270	9,869	8,611	3,000	--
Yellow-poplar	--	--	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--	--	--
Black cherry	55,406	--	24,102	21,411	5,629	2,219	2,045	--	--	--	--
Butternut	--	--	--	--	--	--	--	--	--	--	--
Elm	396,325	--	136,112	107,178	54,551	36,184	30,911	10,619	12,413	7,790	567
Paper birch	376,599	--	217,490	90,841	43,547	12,895	5,382	3,427	3,017	--	--
Other hardwoods	432	--	432	--	--	--	--	--	--	--	--
Total	9,899,597	--	2,954,816	2,391,316	1,796,366	1,215,564	702,775	338,120	388,131	102,026	10,483
All species	15,246,212	1,339,463	4,040,398	3,281,449	2,519,845	1,676,850	1,006,539	573,055	646,307	151,823	10,483

[1/] International 1/4-inch rule.

Table 32.--Net volume of growing stock on commercial forest land by species group and forest type, Western Upper Peninsula, Michigan, 1980

(In thousand cubic feet)

Species group	All types	Forest type						
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
SOFTWOODS								
White pine	153,771	1,251	7,427	49,678	16,770	3,408	4,524	4,214
Red pine	73,688	4,455	43,499	4,656	3,857	142	3,556	137
Jack pine	104,739	83,117	2,538	939	697	428	5,121	--
White spruce	207,633	189	804	5,481	50,915	23,881	4,150	7,971
Black spruce	136,530	1,121	1,235	1,894	21,972	1,874	68,791	17,224
Balsam fir	405,475	878	2,197	5,006	139,620	4,095	14,796	25,746
Hemlock	281,531	--	--	531	5,499	--	643	424
Tamarack	34,916	--	--	96	4,362	338	11,031	4,230
Northern white-cedar	330,049	--	--	793	33,214	1,838	20,888	158,987
Other softwoods	337	--	140	--	--	--	77	--
Total	1,728,669	91,011	57,840	69,074	276,906	36,004	133,577	218,933
HARDWOODS								
Select white oaks	769	--	--	--	--	--	--	--
Select red oaks	85,076	1,469	1,182	585	498	--	--	--
Other red oaks	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--
Yellow birch	321,572	--	--	91	9,049	104	1,393	4,740
Hard maple	1,404,710	--	574	2,618	5,276	1,081	288	2,606
Soft maple	628,509	176	1,097	4,125	26,238	1,183	2,476	7,767
Beech	488	--	--	--	--	--	--	--
Ash	130,790	--	--	--	2,628	--	1,787	3,294
Balsam poplar	42,799	--	90	--	5,425	34	289	2,603
Cottonwood	73	--	--	--	--	--	--	--
Bigtooth aspen	104,484	635	3,080	--	1,488	--	99	122
Quaking aspen	643,017	4,973	4,738	6,404	29,609	12,261	7,095	3,019
Basswood	209,228	--	--	206	193	--	--	--
Yellow-poplar	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--
Black cherry	53,658	--	--	--	3,245	75	165	279
Butternut	--	--	--	--	--	--	--	--
Elm	148,178	--	--	96	4,103	314	--	209
Paper birch	282,834	235	2,891	11,225	24,845	1,625	6,456	13,758
Other hardwoods	177	--	--	--	--	--	--	--
Total	4,056,362	7,488	13,652	25,350	112,597	16,677	20,048	38,397
All species	5,785,031	98,499	71,492	94,424	389,503	52,681	153,625	257,330

(Table 32 continued on next page)

(Table 32 continued)

Species group	Forest type							
	Tamarack	Oak hickory	Elm-ash-soft maple	Maple-birch	Aspen	Paper birch	Exotic	Non-stocked
SOFTWOODS								
White pine	342	1,012	1,891	42,643	15,881	4,674	--	56
Red pine	--	1,358	--	877	9,667	1,484	--	--
Jack pine	--	--	--	2,693	6,078	3,025	--	103
White spruce	53	166	9,006	65,909	32,209	6,899	--	--
Black spruce	2,449	234	2,989	7,098	7,374	2,275	--	--
Balsam fir	1,086	173	15,528	128,614	54,977	12,759	--	--
Hemlock	--	--	7,488	264,482	1,718	746	--	--
Tamarack	9,935	--	527	--	2,864	1,533	--	--
Northern white-cedar	1,397	--	23,063	76,569	7,347	5,953	--	--
Other softwoods	--	--	--	120	--	--	--	--
Total	15,262	2,943	60,492	589,005	138,115	39,348	--	159
HARDWOODS								
Select white oaks	--	--	--	--	769	--	--	--
Select red oaks	--	19,537	563	47,162	10,513	3,567	--	--
Other red oaks	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--
Yellow birch	--	306	12,895	288,270	3,926	798	--	--
Hard maple	--	3,757	8,002	1,346,656	26,195	7,657	--	--
Soft maple	--	2,055	34,652	485,081	46,429	17,230	--	--
Beech	--	--	--	488	--	--	--	--
Ash	--	121	49,472	65,368	7,394	726	--	--
Balsam poplar	319	--	1,043	6,626	25,227	1,143	--	--
Cottonwood	--	--	--	--	73	--	--	--
Bigtooth aspen	--	2,180	--	25,436	65,577	5,867	--	--
Quaking aspen	694	646	6,353	185,057	366,545	15,406	--	217
Basswood	--	--	1,927	202,087	4,517	298	--	--
Yellow-poplar	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--
Black cherry	--	--	583	44,041	4,783	487	--	--
Butternut	--	--	--	--	--	--	--	--
Elm	--	--	12,047	121,431	9,522	456	--	--
Paper birch	339	1,895	4,903	62,022	49,118	103,400	--	122
Other hardwoods	--	--	67	110	--	--	--	--
Total	1,352	30,497	132,507	2,879,835	620,588	157,035	--	339
All species	16,614	33,440	192,999	3,468,840	758,703	196,383	--	498

Table 33.--Net volume of sawtimber on commercial forest land by species group and forest type, Western Upper Peninsula, Michigan, 1980

(In thousand board feet)[1/]

Species group	All types	Forest type: Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
SOFTWOODS								
White pine	780,033	6,454	35,550	244,152	83,369	16,274	23,412	24,913
Red pine	279,874	19,679	143,354	24,903	19,914	756	14,147	698
Jack pine	276,692	223,371	6,307	3,891	1,473	1,165	12,929	--
White spruce	745,345	909	1,637	18,686	168,137	60,139	17,545	34,552
Black spruce	153,343	2,045	--	3,537	32,158	2,869	47,860	27,520
Balsam fir	610,899	4,368	3,649	5,977	210,862	7,168	18,127	22,242
Hemlock	1,444,202	--	--	3,122	26,336	--	3,090	2,505
Tamarack	61,261	--	--	495	10,346	1,171	11,349	3,836
Northern white-cedar	994,377	--	--	1,911	100,278	5,051	69,675	421,177
Other softwoods	589	--	--	--	--	--	--	--
Total	5,346,615	256,826	190,497	306,674	652,873	94,593	218,134	537,443
HARDWOODS								
Select white oaks	3,693	--	--	--	--	--	--	--
Select red oaks	298,531	1,293	4,580	774	--	--	--	--
Other red oaks	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--
Yellow birch	1,049,376	--	--	--	34,122	--	5,897	18,858
Hard maple	4,009,886	--	--	3,673	15,336	1,491	910	5,340
Soft maple	1,168,709	--	699	5,118	45,430	--	1,030	13,029
Beech	821	--	--	--	--	--	--	--
Ash	278,324	--	--	--	3,190	--	786	3,885
Balsam poplar	153,205	--	511	--	16,719	--	1,019	6,175
Cottonwood	371	--	--	--	--	--	--	--
Bigtooth aspen	242,428	1,454	2,773	--	7,368	--	--	684
Quaking aspen	1,360,347	--	2,994	9,281	57,719	8,291	13,752	9,394
Basswood	505,144	--	--	--	432	--	--	--
Yellow-poplar	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--
Black cherry	55,406	--	--	--	2,127	--	--	456
Butternut	--	--	--	--	--	--	--	--
Elm	396,325	--	--	--	4,786	604	--	390
Paper birch	376,599	667	3,530	20,671	33,951	1,315	9,428	24,310
Other hardwoods	432	--	--	--	--	--	--	--
Total	9,899,597	3,414	15,087	39,517	221,180	11,701	32,822	82,521
All species	15,246,212	260,240	205,584	346,191	874,053	106,294	250,956	619,964

(Table 33 continued on next page)

1/ International 1/4-inch rule.

(Table 33 continued)

Species group	Forest type							
	Tamarack	Oak hickory	Elm-ash-soft maple	Maple-birch	Aspen	Paper birch	Exotic	Non-stocked
SOFTWOODS								
White pine	2,024	4,980	9,775	223,227	82,401	23,502	--	--
Red pine	--	7,344	--	4,501	36,761	7,817	--	--
Jack pine	--	--	--	1,831	12,014	13,711	--	--
White spruce	--	840	37,205	268,413	114,637	22,645	--	--
Black spruce	1,834	696	6,240	16,692	9,886	2,006	--	--
Balsam fir	1,503	--	19,423	221,391	83,471	12,718	--	--
Hemlock	--	--	37,506	1,361,187	7,101	3,355	--	--
Tamarack	24,009	--	2,377	--	7,031	647	--	--
Northern white-cedar	3,695	--	70,373	290,864	18,348	13,005	--	--
Other softwoods	--	--	--	589	--	--	--	--
Total	33,065	13,860	182,899	2,388,695	371,650	99,406	--	--
HARDWOODS								
Select white oaks	--	--	--	--	3,693	--	--	--
Select red oaks	--	68,034	1,564	185,151	29,869	7,266	--	--
Other red oaks	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--
Yellow birch	--	670	40,629	945,897	2,077	1,226	--	--
Hard maple	--	2,079	16,053	3,931,778	25,594	7,632	--	--
Soft maple	--	682	74,076	994,681	24,152	9,812	--	--
Beech	--	--	--	821	--	--	--	--
Ash	--	675	122,793	135,112	11,266	617	--	--
Balsam poplar	1,430	--	1,498	24,716	96,302	4,835	--	--
Cottonwood	--	--	--	--	371	--	--	--
Bigtooth aspen	--	4,279	--	87,215	126,156	12,499	--	--
Quaking aspen	2,090	2,233	8,177	512,984	694,024	39,408	--	--
Basswood	--	--	4,370	496,682	3,660	--	--	--
Yellow-poplar	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--
Black cherry	--	--	986	47,212	4,625	--	--	--
Butternut	--	--	--	--	--	--	--	--
Elm	--	--	38,936	341,274	9,036	1,299	--	--
Paper birch	--	3,582	8,903	132,833	55,307	82,102	--	--
Other hardwoods	--	--	432	--	--	--	--	--
Total	3,520	82,234	318,417	7,836,356	1,086,132	166,696	--	--
All species	36,585	96,094	501,316	10,225,051	1,457,782	266,102	--	--

Table 34.--Net volume of growing stock on commercial forest land by species group and ownership class, Western Upper Peninsula, Michigan, 1980

(In thousand cubic feet)

Species group	All owners	Ownership class									
		National Forest	Bureau of Land Mgmt.	Misc. federal	Indian	State	County & municipal	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.
SOFTWOODS											
White pine	153,771	33,494	--	--	--	25,230	645	32,068	5,073	29,343	27,918
Red pine	73,688	29,079	--	--	--	12,441	--	9,265	484	9,636	12,783
Jack pine	104,739	41,016	--	--	--	24,637	7,153	8,386	--	7,164	16,383
White spruce	207,633	42,347	--	112	336	33,184	1,097	58,970	5,784	34,502	31,301
Black spruce	136,530	22,062	--	94	--	34,923	3,182	34,786	2,261	13,791	25,431
Balsam fir	405,475	90,119	--	1,820	106	66,336	4,672	105,480	12,404	51,441	73,097
Hemlock	281,531	46,140	--	--	2,926	19,389	2,455	117,426	10,546	33,073	49,576
Tamarack	34,916	4,750	--	--	--	10,163	628	9,421	1,148	3,016	5,790
Northern white-cedar	330,049	40,363	--	--	265	60,974	7,672	107,638	6,944	65,089	41,104
Other softwoods	337	140	--	--	--	--	--	--	--	120	77
Total	1,728,669	349,510	--	2,026	3,633	287,277	27,504	483,440	44,644	247,175	283,460
HARDWOODS											
Select white oaks	769	769	--	--	--	--	--	--	--	--	--
Select red oaks	85,076	5,046	--	--	258	13,784	--	21,619	3,718	20,688	19,963
Other red oaks	--	--	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--	--	--
Yellow birch	321,572	57,113	--	107	3,879	26,141	4,751	121,308	9,686	50,190	48,397
Hard maple	1,404,710	262,451	--	--	7,239	104,263	23,436	488,150	60,924	227,258	230,989
Soft maple	628,509	96,640	--	--	5,829	68,187	6,661	179,001	31,416	104,088	136,687
Beech	488	--	--	--	--	265	--	223	--	--	--
Ash	130,790	35,522	--	--	423	12,976	6,681	39,090	4,273	15,021	16,804
Balsam poplar	42,799	966	--	--	--	16,946	--	9,604	1,619	2,085	11,579
Cottonwood	73	--	--	--	--	--	--	--	73	--	--
Bigtooth aspen	104,484	17,697	--	--	3,682	17,813	2,298	13,365	2,789	19,629	27,211
Quaking aspen	643,017	159,197	--	--	4,734	90,346	13,662	107,476	25,597	95,787	146,218
Basswood	209,228	53,204	--	--	275	19,830	4,040	43,852	14,375	32,893	40,759
Yellow-poplar	--	--	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--	--	--
Black cherry	53,658	8,671	--	--	--	5,298	1,384	20,492	3,622	5,640	8,551
Butternut	--	--	--	--	--	--	--	--	--	--	--
Elm	148,178	31,207	--	--	216	15,342	3,768	34,349	13,656	19,271	30,369
Paper birch	282,834	46,008	--	343	--	38,436	2,526	70,169	13,258	48,958	63,136
Other hardwoods	177	--	--	--	--	--	--	--	--	67	110
Total	4,056,362	774,491	--	450	26,535	429,627	69,207	1,148,698	185,006	641,575	780,773
All species	5,785,031	1,124,001	--	2,476	30,168	716,904	96,711	1,632,138	229,650	888,750	1,064,233

Table 35.--Net volume of sawtimber on commercial forest land by species group and ownership class, Western Upper Peninsula, Michigan, 1980

(In thousand board feet)[1/]

Species group	All owners	Ownership class									
		National Forest	Bureau of Land Mgmt.	Misc. federal	Indian	State	County & municipal	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.
SOFTWOODS											
White pine	780,033	168,585	--	--	--	127,912	2,672	159,520	25,018	154,120	142,206
Red pine	279,874	69,803	--	--	--	55,402	--	44,178	1,360	50,180	58,951
Jack pine	276,692	72,215	--	--	--	90,740	19,055	18,394	--	19,119	57,169
White spruce	745,345	160,352	--	547	709	121,012	3,679	208,573	19,114	128,150	103,209
Black spruce	153,343	17,622	--	--	--	39,313	5,469	40,017	2,349	23,730	24,843
Balsam fir	610,899	142,262	--	5,406	--	98,480	5,888	144,799	13,709	82,091	118,264
Hemlock	1,444,202	236,632	--	--	15,318	103,626	10,533	617,557	54,930	166,276	239,330
Tamarack	61,261	4,567	--	--	--	15,155	1,460	20,365	1,891	8,072	9,751
Northern white-cedar	994,377	129,859	--	--	1,126	135,405	27,854	348,233	12,430	230,327	109,143
Other softwoods	589	--	--	--	--	--	--	--	--	589	--
Total	5,346,615	1,001,897	--	5,953	17,153	787,045	76,610	1,601,636	130,801	862,654	862,866
HARDWOODS											
Select white oaks	3,693	3,693	--	--	--	--	--	--	--	--	--
Select red oaks	298,531	20,095	--	--	1,410	45,570	--	75,463	15,591	72,191	68,211
Other red oaks	--	--	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--	--	--
Yellow birch	1,049,376	165,080	--	591	12,291	87,051	13,179	445,122	29,172	152,879	144,011
Hard maple	4,009,886	838,278	--	--	14,572	266,446	48,267	1,601,705	111,064	635,631	493,923
Soft maple	1,168,709	163,865	--	--	5,783	108,297	15,350	404,014	52,306	185,118	233,976
Beech	821	--	--	--	--	821	--	--	--	--	--
Ash	278,324	65,693	--	--	1,855	25,861	11,210	101,302	5,421	39,958	27,024
Balsam poplar	153,205	5,799	--	--	--	70,207	--	27,362	4,821	3,972	41,044
Cottonwood	371	--	--	--	--	--	--	--	371	--	--
Bigtooth aspen	242,428	31,241	--	--	9,897	32,480	7,396	34,979	8,654	43,901	73,880
Quaking aspen	1,360,347	332,869	--	--	7,617	189,449	26,325	222,969	53,902	230,459	296,757
Basswood	505,144	110,954	--	--	1,516	53,255	4,017	118,720	37,350	78,605	100,727
Yellow-poplar	--	--	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--	--	--
Black cherry	55,406	11,114	--	--	--	6,712	750	19,969	3,357	7,103	6,401
Butternut	--	--	--	--	--	--	--	--	--	--	--
Elm	396,325	68,412	--	--	651	41,788	9,797	99,559	38,992	55,677	81,449
Paper birch	376,599	51,524	--	1,156	--	40,199	3,358	113,085	10,779	76,829	79,669
Other hardwoods	432	--	--	--	--	--	--	--	--	432	--
Total	9,899,597	1,868,617	--	1,747	55,592	968,136	139,649	3,264,249	371,780	1,582,755	1,647,072
All species	15,246,212	2,870,514	--	7,700	72,745	1,755,181	216,259	4,865,886	502,581	2,445,409	2,509,938

[1/]International 1/4-inch rule.

Table 36.--Net volume of growing stock on commercial forest land by forest type and stand-age class, Western Upper Peninsula, Michigan, 1980

(In thousand cubic feet)

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	98,499	--	1,559	11,567	9,255	32,790	29,341	5,422	4,612	2,380	1,573	--	--	--
Red pine	71,492	--	2,983	11,001	13,790	--	1,562	13,838	2,179	7,521	1,377	15,296	1,945	--
White pine	94,424	--	--	1,687	1,558	1,572	--	33,728	4,481	21,874	10,077	7,966	8,283	3,198
Balsam fir	389,503	10,987	10,828	16,617	31,402	76,164	63,194	50,732	47,569	26,927	21,203	24,194	3,380	6,306
White spruce	52,681	1,738	1,004	--	16,686	4,180	8,883	4,565	1,806	--	--	13,819	--	--
Black spruce	153,625	8,475	8,261	12,754	11,107	16,184	26,504	24,651	9,258	--	4,193	16,727	10,661	4,850
Northern white-cedar	257,330	1,031	3,638	3,781	1,612	11,410	23,560	30,153	30,333	32,982	18,621	51,211	24,735	24,263
Tamarack	16,614	1,801	2,270	1,709	69	2,116	3,794	389	--	--	2,492	--	--	1,974
Oak-hickory	33,440	--	--	1,117	2,740	7,160	--	5,203	--	2,897	6,202	4,995	3,126	--
Elm-ash-soft maple	192,999	4,985	9,649	3,530	8,883	10,596	14,811	16,559	18,284	21,565	11,251	23,246	26,519	23,121
Maple-birch	3,468,840	37,635	42,756	42,609	153,387	521,681	534,345	227,894	234,821	305,296	343,581	586,042	290,797	147,996
Aspen	758,703	33,209	28,600	21,039	102,778	178,303	188,152	64,698	85,492	34,853	6,424	15,155	--	--
Paper birch	196,383	2,578	4,583	2,557	11,828	23,099	65,329	34,052	18,749	12,341	10,479	--	8,160	2,628
Exotic	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nonstocked	498	173	108	--	217	--	--	--	--	--	--	--	--	--
All types	5,785,031	102,612	116,239	129,968	365,312	885,255	959,475	511,884	457,584	468,636	437,473	758,651	377,606	214,336

Table 37.--Net volume of sawtimber on commercial forest land by forest type and stand-age class, Western Upper Peninsula, Michigan, 1980

(In thousand board feet)[1/]

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	260,240	--	5,429	10,070	14,164	74,451	110,524	20,895	17,409	948	6,350	--	--	--
Red pine	205,584	--	6,332	10,073	20,519	--	4,664	48,362	7,358	24,774	5,619	71,971	5,912	--
White pine	346,191	--	--	2,898	3,743	2,899	--	115,551	18,396	81,861	40,784	33,073	34,441	12,545
Balsam fir	874,053	17,608	14,071	28,924	52,962	149,495	120,002	108,183	126,929	75,814	68,791	76,873	10,729	23,672
White spruce	106,294	8,026	1,253	--	7,883	10,933	19,053	9,233	5,909	--	--	44,004	--	--
Black spruce	250,956	10,354	9,309	9,371	13,212	23,602	22,313	37,888	7,272	--	15,027	56,370	31,922	14,316
Northern white-cedar	619,964	1,246	3,653	5,418	1,388	14,568	38,943	45,231	48,956	76,314	55,792	161,152	80,991	36,322
Tamarack	36,585	5,865	5,804	1,681	--	3,022	5,959	--	--	--	6,436	--	--	7,818
Oak-hickory	96,094	--	--	2,078	5,523	17,199	--	9,538	--	11,944	19,723	18,046	12,043	--
Elm-ash-soft maple	501,316	11,272	13,838	6,317	16,223	15,511	30,007	26,088	37,089	59,043	41,791	80,346	84,417	79,374
Maple-birch	10,225,051	74,966	95,623	79,044	257,949	941,264	1,071,215	540,387	703,863	1,050,921	1,264,219	2,257,488	1,176,032	712,080
Aspen	1,457,782	51,778	43,940	19,052	136,754	258,152	354,509	161,162	256,035	103,714	19,953	52,733	--	--
Paper birch	266,102	3,257	4,813	1,184	18,796	23,086	53,901	40,546	39,183	28,370	25,775	--	20,603	6,588
Exotic	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All types	15,246,212	184,372	204,065	176,110	549,116	1,534,182	1,831,090	1,163,064	1,268,399	1,513,703	1,570,250	2,852,056	1,457,090	942,715

[1/] International 1/4-inch rule.

Table 38.--Net volume of growing stock on commercial forest land by forest type, stand-size class, and basal-area class, Western Upper Peninsula, Michigan, 1980

(In thousand cubic feet)

Forest type and stand-size class	All classes	Basal-area class (square feet per acre)						
		0-10	11-20	21-30	31-40	41-50	51-60	61-70
Jack pine								
Sawtimber	42,271	--	--	--	--	2,860	10,387	4,284
Poletimber	54,250	--	853	--	--	428	4,717	6,327
Sapling & seedling	1,978	--	--	184	928	621	245	--
All stands	98,499	--	853	184	928	3,909	15,349	10,611
Red pine								
Sawtimber	43,718	--	--	--	--	--	--	--
Poletimber	26,283	--	--	--	--	1,492	1,928	--
Sapling & seedling	1,491	--	--	739	--	--	752	--
All stands	71,492	--	--	739	--	1,492	2,680	--
White pine								
Sawtimber	87,835	--	--	--	844	--	--	1,504
Poletimber	6,589	--	--	--	--	--	--	--
Sapling & seedling	--	--	--	--	--	--	--	--
All stands	94,424	--	--	--	844	--	--	1,504
Balsam fir								
Sawtimber	120,928	--	--	--	--	--	3,579	1,569
Poletimber	233,872	--	--	549	570	797	1,695	20,586
Sapling & seedling	34,703	77	1,563	269	4,686	2,414	3,082	7,330
All stands	389,503	77	1,563	818	5,256	3,211	8,356	29,485
White spruce								
Sawtimber	18,988	--	--	--	--	1,369	--	1,993
Poletimber	30,951	--	--	--	--	782	--	--
Sapling & seedling	2,742	--	--	502	--	1,236	1,004	--
All stands	52,681	--	--	502	--	3,387	1,004	1,993
Black spruce								
Sawtimber	11,358	--	--	--	--	--	--	--
Poletimber	108,476	--	--	--	1,450	1,744	6,186	2,561
Sapling & seedling	33,791	80	276	410	3,026	6,916	2,914	7,988
All stands	153,625	80	276	410	4,476	8,660	9,100	10,549
Northern white-cedar								
Sawtimber	132,786	--	--	--	--	964	898	2,108
Poletimber	115,131	--	--	--	--	--	--	969
Sapling & seedling	9,413	--	--	272	255	1,302	--	504
All stands	257,330	--	--	272	255	2,266	898	3,581

(Table 38 continued on next page)

(Table 38 continued)

Forest type and stand-size class	Basal-area class (square feet per acre)						
	71-80	81-90	91-100	101-120	121-150	151-180	181+
Jack pine							
Sawtimber	5,895	3,949	9,981	4,915	--	--	--
Poletimber	1,303	2,972	4,025	--	31,381	--	2,244
Sapling & seedling	--	--	--	--	--	--	--
All stands	7,198	6,921	14,006	4,915	31,381	--	2,244
Red pine							
Sawtimber	2,938	1,945	2,179	--	25,077	11,579	--
Poletimber	--	1,075	1,969	--	9,032	10,787	--
Sapling & seedling	--	--	--	--	--	--	--
All stands	2,938	3,020	4,148	--	34,109	22,366	--
White pine							
Sawtimber	7,267	--	11,388	9,485	14,272	43,075	--
Poletimber	3,245	1,572	1,772	--	--	--	--
Sapling & seedling	--	--	--	--	--	--	--
All stands	10,512	1,572	13,160	9,485	14,272	43,075	--
Balsam fir							
Sawtimber	--	12,366	13,714	15,630	64,905	--	9,165
Poletimber	13,769	7,905	16,755	61,358	46,491	52,214	11,183
Sapling & seedling	1,545	2,335	5,361	2,864	2,250	927	--
All stands	15,314	22,606	35,830	79,852	113,646	53,141	20,348
White spruce							
Sawtimber	1,806	1,939	--	5,275	6,606	--	--
Poletimber	3,448	1,355	2,397	--	18,404	4,565	--
Sapling & seedling	--	--	--	--	--	--	--
All stands	5,254	3,294	2,397	5,275	25,010	4,565	--
Black spruce							
Sawtimber	2,528	--	--	--	8,830	--	--
Poletimber	1,287	5,330	11,049	23,216	31,376	8,319	15,958
Sapling & seedling	3,709	1,139	4,189	2,236	908	--	--
All stands	7,524	6,469	15,238	25,452	41,114	8,319	15,958
Northern white-cedar							
Sawtimber	1,889	--	6,379	30,851	21,456	27,212	41,029
Poletimber	2,408	2,211	9,283	11,114	23,991	28,106	37,049
Sapling & seedling	--	2,449	--	1,593	2,685	353	--
All stands	4,297	4,660	15,662	43,558	48,132	55,671	78,078

(Table 38 continued on next page)

(Table 38 continued)

Forest type and stand-size class	All classes	Basal-area class (square feet per acre) 0-10	11-20	21-30	31-40	41-50	51-60	61-70
Tamarack								
Sawtimber	4,231	--	--	301	--	1,974	--	--
Poletimber	5,790	--	--	--	901	--	1,289	1,601
Sapling & seedling	6,593	94	968	624	2,059	--	--	397
All stands	16,614	94	968	925	2,960	1,974	1,289	1,998
Oak-hickory								
Sawtimber	17,222	--	--	--	--	--	--	--
Poletimber	15,101	--	--	--	--	--	--	--
Sapling & seedling	1,117	--	--	--	--	--	--	--
All stands	33,440	--	--	--	--	--	--	--
Elm-ash-soft maple								
Sawtimber	101,769	--	--	--	540	--	897	--
Poletimber	73,799	--	--	385	1,476	656	--	2,184
Sapling & seedling	17,431	--	748	--	908	1,781	1,293	4,604
All stands	192,999	--	748	385	2,924	2,437	2,190	6,788
Maple-birch								
Sawtimber	1,922,331	--	--	--	723	5,545	8,012	27,905
Poletimber	1,443,933	--	--	--	--	7,943	7,321	45,741
Sapling & seedling	102,576	150	932	1,402	3,279	11,215	14,330	14,608
All stands	3,468,840	150	932	1,402	4,002	24,703	29,663	88,254
Aspen								
Sawtimber	156,204	--	597	--	1,734	3,907	4,903	10,750
Poletimber	532,624	--	--	1,060	4,371	7,267	13,636	41,561
Sapling & seedling	69,875	440	4,409	6,437	10,762	14,002	6,363	10,119
All stands	758,703	440	5,006	7,497	16,867	25,176	24,902	62,430
Paper birch								
Sawtimber	33,056	--	--	--	765	--	--	--
Poletimber	153,609	--	--	--	--	960	2,842	1,417
Sapling & seedling	9,718	--	66	705	401	1,490	--	1,099
All stands	196,383	--	66	705	1,166	2,450	2,842	2,516
Exotic								
Sawtimber	--	--	--	--	--	--	--	--
Poletimber	--	--	--	--	--	--	--	--
Sapling & seedling	--	--	--	--	--	--	--	--
All stands	--	--	--	--	--	--	--	--
Nonstocked	498	225	273	--	--	--	--	--
All types								
Sawtimber	2,692,697	--	597	301	4,606	16,619	28,676	50,113
Poletimber	2,800,408	--	853	1,994	8,768	22,069	39,614	122,947
Sapling & seedling	291,428	841	8,962	11,544	26,304	40,977	29,983	46,649
Nonstocked	498	225	273	--	--	--	--	--
All stands	5,785,031	1,066	10,685	13,839	39,678	79,665	98,273	219,709

(Table 38 continued on next page)

(Table 38 continued)

Forest type and stand-size class	Basal-area class (square feet per acre)						
	71-80	81-90	91-100	101-120	121-150	151-180	181+
Tamarack							
Sawtimber	--	--	--	--	1,956	--	--
Poletimber	1,999	--	--	--	--	--	--
Sapling & seedling	948	1,503	--	--	--	--	--
All stands	2,947	1,503	--	--	1,956	--	--
Oak-hickory							
Sawtimber	--	4,103	3,039	2,898	--	7,182	--
Poletimber	--	--	--	9,851	5,250	--	--
Sapling & seedling	--	--	--	1,117	--	--	--
All stands	--	4,103	3,039	13,866	5,250	7,182	--
Elm-ash-soft maple							
Sawtimber	--	2,943	3,109	14,056	40,543	35,909	3,772
Poletimber	3,217	4,017	10,999	9,452	17,774	20,084	3,555
Sapling & seedling	3,590	--	3,892	615	--	--	--
All stands	6,807	6,960	18,000	24,123	58,317	55,993	7,327
Maple-birch							
Sawtimber	67,137	65,035	180,502	406,108	757,550	306,048	97,766
Poletimber	65,928	72,851	136,588	345,957	567,564	175,677	18,363
Sapling & seedling	15,030	14,202	8,544	15,200	3,684	--	--
All stands	148,095	152,088	325,634	767,265	1,328,798	481,725	116,129
Aspen							
Sawtimber	15,342	17,824	9,433	22,837	39,653	29,224	--
Poletimber	38,315	40,252	55,530	95,240	147,275	50,568	37,549
Sapling & seedling	6,535	688	3,428	6,692	--	--	--
All stands	60,192	58,764	68,391	124,769	186,928	79,792	37,549
Paper birch							
Sawtimber	--	1,886	1,350	11,404	12,500	--	5,151
Poletimber	8,919	7,234	11,941	20,275	80,969	19,052	--
Sapling & seedling	1,305	2,528	--	2,124	--	--	--
All stands	10,224	11,648	13,291	33,803	93,469	19,052	5,151
Exotic							
Sawtimber	--	--	--	--	--	--	--
Poletimber	--	--	--	--	--	--	--
Sapling & seedling	--	--	--	--	--	--	--
All stands	--	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--	--
All types							
Sawtimber	104,802	111,990	241,074	523,459	993,348	460,229	156,883
Poletimber	143,838	146,774	262,308	576,463	979,507	369,372	125,901
Sapling & seedling	32,662	24,844	25,414	32,441	9,527	1,280	--
Nonstocked	--	--	--	--	--	--	--
All stands	281,302	283,608	528,796	1,132,363	1,982,382	830,881	282,784

Table 39.--Net volume of sawtimber on commercial forest land by forest type, stand-size class, and basal-area class, Western Upper Peninsula, Michigan, 1980

(In thousand board feet)[1/]

Forest type and stand-size class	All classes	Basal-area class (square feet per acre)						
		0-10	11-20	21-30	31-40	41-50	51-60	61-70
Jack pine								
Sawtimber	161,918	--	--	--	--	12,649	48,056	16,042
Poletimber	92,096	--	2,399	--	--	--	9,698	26,047
Sapling & seedling	6,226	--	--	--	2,383	2,971	872	--
All stands	260,240	--	2,399	--	2,383	15,620	58,626	42,089
Red pine								
Sawtimber	168,660	--	--	--	--	--	--	--
Poletimber	33,308	--	--	--	--	2,716	5,116	--
Sapling & seedling	3,616	--	--	--	--	--	3,616	--
All stands	205,584	--	--	--	--	2,716	8,732	--
White pine								
Sawtimber	332,197	--	--	--	3,033	--	--	6,378
Poletimber	13,994	--	--	--	--	--	--	--
Sapling & seedling	--	--	--	--	--	--	--	--
All stands	346,191	--	--	--	3,033	--	--	6,378
Balsam fir								
Sawtimber	375,925	--	--	--	--	--	11,999	6,462
Poletimber	445,180	--	--	584	666	1,889	4,366	40,642
Sapling & seedling	52,948	360	2,175	834	9,804	4,450	2,703	6,783
All stands	874,053	360	2,175	1,418	10,470	6,339	19,068	53,887
White spruce								
Sawtimber	64,529	--	--	--	--	6,391	--	8,225
Poletimber	32,486	--	--	--	--	1,977	--	--
Sapling & seedling	9,279	--	--	2,243	--	5,783	1,253	--
All stands	106,294	--	--	2,243	--	14,151	1,253	8,225
Black spruce								
Sawtimber	35,095	--	--	--	--	--	--	--
Poletimber	183,627	--	--	--	2,657	2,057	7,926	5,211
Sapling & seedling	32,234	--	--	--	3,745	10,520	4,376	2,153
All stands	250,956	--	--	--	6,402	12,577	12,302	7,364
Northern white-cedar								
Sawtimber	447,955	--	--	--	--	2,729	4,341	8,747
Poletimber	159,874	--	--	--	--	--	--	690
Sapling & seedling	12,135	--	--	913	--	--	--	334
All stands	619,964	--	--	913	--	2,729	4,341	9,771

(Table 39 continued on next page)

(Table 39 continued)

Forest type and stand-size class	Basal-area class (square feet per acre)						
	71-80	81-90	91-100	101-120	121-150	151-180	181+
Jack pine							
Sawtimber	20,565	14,400	36,336	13,870	--	--	--
Poletimber	1,617	5,416	9,418	--	36,547	--	954
Sapling & seedling	--	--	--	--	--	--	--
All stands	22,182	19,816	45,754	13,870	36,547	--	954
Red pine							
Sawtimber	10,283	5,912	7,358	--	102,577	42,530	--
Poletimber	--	2,684	2,676	--	7,397	12,719	--
Sapling & seedling	--	--	--	--	--	--	--
All stands	10,283	8,596	10,034	--	109,974	55,249	--
White pine							
Sawtimber	33,882	--	48,366	32,188	51,920	156,430	--
Poletimber	6,641	2,899	4,454	--	--	--	--
Sapling & seedling	--	--	--	--	--	--	--
All stands	40,523	2,899	52,820	32,188	51,920	156,430	--
Balsam fir							
Sawtimber	--	39,310	46,533	46,403	196,074	--	29,144
Poletimber	32,726	8,537	33,370	121,230	77,125	109,013	15,032
Sapling & seedling	2,190	4,570	10,448	2,919	5,712	--	--
All stands	34,916	52,417	90,351	170,552	278,911	109,013	44,176
White spruce							
Sawtimber	5,909	5,942	--	18,077	19,985	--	--
Poletimber	3,243	1,642	6,203	--	10,188	9,233	--
Sapling & seedling	--	--	--	--	--	--	--
All stands	9,152	7,584	6,203	18,077	30,173	9,233	--
Black spruce							
Sawtimber	6,931	--	--	--	28,164	--	--
Poletimber	983	5,358	21,261	41,602	43,354	19,806	33,412
Sapling & seedling	3,733	2,269	5,438	--	--	--	--
All stands	11,647	7,627	26,699	41,602	71,518	19,806	33,412
Northern white-cedar							
Sawtimber	6,294	--	20,402	108,220	73,167	98,269	125,786
Poletimber	3,777	4,535	10,813	11,355	32,557	41,324	54,823
Sapling & seedling	--	5,136	--	2,681	2,638	433	--
All stands	10,071	9,671	31,215	122,256	108,362	140,026	180,609

(Table 39 continued on next page)

(Table 39 continued)

Forest type and stand-size class	All classes	Basal-area class (square feet per acre) 0-10	11-20	21-30	31-40	41-50	51-60	61-70
Tamarack								
Sawtimber	14,597	--	--	748	--	7,818	--	--
Poletimber	8,638	--	--	--	669	--	2,758	1,891
Sapling & seedling	13,350	--	4,174	811	4,846	--	--	--
All stands	36,585	--	4,174	1,559	5,515	7,818	2,758	1,891
Oak-hickory								
Sawtimber	61,756	--	--	--	--	--	--	--
Poletimber	32,260	--	--	--	--	--	--	--
Sapling & seedling	2,078	--	--	--	--	--	--	--
All stands	96,094	--	--	--	--	--	--	--
Elm-ash-soft maple								
Sawtimber	345,648	--	--	--	2,378	--	3,706	--
Poletimber	125,353	--	--	--	1,112	734	--	3,391
Sapling & seedling	30,315	--	954	--	4,047	3,327	485	4,872
All stands	501,316	--	954	--	7,537	4,061	4,191	8,263
Maple-birch								
Sawtimber	7,423,179	--	--	--	2,950	24,761	30,998	108,645
Poletimber	2,583,050	--	--	--	--	13,768	5,646	81,935
Sapling & seedling	218,822	751	507	4,189	5,086	16,304	29,890	32,061
All stands	10,225,051	751	507	4,189	8,036	54,833	66,534	222,641
Aspen								
Sawtimber	490,671	--	2,224	--	6,128	12,316	16,856	35,772
Poletimber	865,754	--	--	2,546	3,668	5,384	18,423	66,118
Sapling & seedling	101,357	--	3,470	11,876	13,403	21,868	12,592	14,780
All stands	1,457,782	--	5,694	14,422	23,199	39,568	47,871	116,670
Paper birch								
Sawtimber	91,486	--	--	--	2,932	--	--	--
Poletimber	165,362	--	--	--	--	617	694	2,804
Sapling & seedling	9,254	--	--	1,298	1,458	--	--	2,018
All stands	266,102	--	--	1,298	4,390	617	694	4,822
Exotic								
Sawtimber	--	--	--	--	--	--	--	--
Poletimber	--	--	--	--	--	--	--	--
Sapling & seedling	--	--	--	--	--	--	--	--
All stands	--	--	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--	--	--
All types								
Sawtimber	10,013,616	0	2,224	748	17,421	66,664	115,956	190,271
Poletimber	4,740,982	0	2,399	3,130	8,772	29,142	54,627	228,729
Sapling & seedling	491,614	1,111	11,280	22,164	44,772	65,223	55,787	63,001
Nonstocked	--	--	--	--	--	--	--	--
All stands	15,246,212	1,111	15,903	26,042	70,965	161,029	226,370	482,001

(Table 39 continued on next page)

(Table 39 continued)

Forest type and stand-size class	Basal-area class (square feet per acre)						
	71-80	81-90	91-100	101-120	121-150	151-180	181+
Tamarack							
Sawtimber	--	--	--	--	6,031	--	--
Poletimber	3,320	--	--	--	--	--	--
Sapling & seedling	462	3,057	--	--	--	--	--
All stands	3,782	3,057	--	--	6,031	--	--
Oak-hickory							
Sawtimber	--	18,483	10,365	11,944	--	20,964	--
Poletimber	--	--	--	22,763	9,497	--	--
Sapling & seedling	--	--	--	2,078	--	--	--
All stands	--	18,483	10,365	36,785	9,497	20,964	--
Elm-ash-soft maple							
Sawtimber	--	8,929	12,015	54,876	133,717	116,343	13,684
Poletimber	4,550	4,600	21,214	15,806	28,758	39,513	5,675
Sapling & seedling	8,446	--	7,637	547	--	--	--
All stands	12,996	13,529	40,866	71,229	162,475	155,856	19,359
Maple-birch							
Sawtimber	272,388	257,445	671,328	1,539,870	2,942,127	1,163,691	408,976
Poletimber	124,258	112,311	209,752	641,735	1,040,333	316,045	37,267
Sapling & seedling	27,064	25,417	28,131	43,347	6,075	--	--
All stands	423,710	395,173	909,211	2,224,952	3,988,535	1,479,736	446,243
Aspen							
Sawtimber	49,712	58,807	28,768	76,353	122,984	80,751	--
Poletimber	49,032	51,543	76,085	177,096	250,404	76,443	89,012
Sapling & seedling	10,863	1,419	3,192	7,894	--	--	--
All stands	109,607	111,769	108,045	261,343	373,388	157,194	89,012
Paper birch							
Sawtimber	--	6,127	4,269	30,411	29,891	--	17,856
Poletimber	9,417	5,417	10,089	30,692	84,314	21,318	--
Sapling & seedling	1,959	1,059	--	1,462	--	--	--
All stands	11,376	12,603	14,358	62,565	114,205	21,318	17,856
Exotic							
Sawtimber	--	--	--	--	--	--	--
Poletimber	--	--	--	--	--	--	--
Sapling & seedling	--	--	--	--	--	--	--
All stands	--	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--	--
All types							
Sawtimber	405,964	415,355	885,740	1,932,212	3,706,637	1,678,978	595,446
Poletimber	239,564	204,942	405,335	1,062,279	1,620,474	645,414	236,175
Sapling & seedling	54,717	42,927	54,846	60,928	14,425	433	--
Nonstocked	--	--	--	--	--	--	--
All stands	700,245	663,224	1,345,921	3,055,419	5,341,536	2,324,825	831,621

1/International 1/4-inch rule.

Table 40.--Net volume of sawtimber on commercial forest land by species group and log-grade class, Western Upper Peninsula, Michigan, 1980

(In thousand board feet)[1/]

Species group	All grades	Log grade 1	2	3	Tie and timber
SOFTWOODS					
White pine	780,033	51,328	97,679	433,711	197,315
Red pine	279,874	3,870	11,768	252,919	11,317
Jack pine	276,692	699	3,108	270,069	2,816
White spruce	745,345	--	36,109	709,236	--
Black spruce	153,343	760	2,695	149,888	--
Balsam fir	610,899	3,018	915	588,913	18,053
Hemlock	1,444,202	25,287	109,919	1,308,996	--
Tamarack	61,261	--	--	61,261	--
Northern white-cedar	994,377	12,008	32,174	950,195	--
Other softwoods	589	--	--	589	--
Total	5,346,615	96,970	294,367	4,725,777	229,501
HARDWOODS					
Select white oaks	3,693	--	52	1,393	2,248
Select red oaks	298,531	26,495	97,415	149,824	24,797
Other red oaks	--	--	--	--	--
Hickory	--	--	--	--	--
Yellow birch	1,049,376	131,272	302,789	570,125	45,190
Hard maple	4,009,884	596,280	1,086,771	2,088,591	238,242
Soft maple	1,168,710	105,476	246,897	795,652	20,685
Beech	821	124	199	469	29
Ash	278,324	36,472	66,713	167,793	7,346
Balsam poplar	153,205	8,765	36,947	96,557	10,936
Cottonwood	371	--	--	345	26
Bigtooth aspen	242,428	16,506	54,127	149,147	22,648
Quaking aspen	1,360,348	43,268	156,647	1,016,770	143,663
Basswood	505,144	56,160	163,362	270,429	15,193
Yellow-poplar	--	--	--	--	--
Black walnut	--	--	--	--	--
Black cherry	55,406	3,526	730	43,482	7,668
Butternut	--	--	--	--	--
Elm	396,325	46,406	145,515	176,655	27,749
Paper birch	376,599	3,134	41,844	300,570	31,051
Other hardwoods	432	--	173	259	--
Total	9,899,597	1,073,884	2,400,181	5,828,061	597,471
All species	15,246,212	1,170,854	2,694,548	10,553,838	826,972

[1/]International 1/4-inch rule.

Table 41.--Net volume of short-log trees on commercial forest land by species group and diameter class, Western Upper Peninsula, Michigan, 1980

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39-0+
SOFTWOODS											
White pine	1,014	258	121	81	--	163	75	--	316	--	--
Red pine	143	--	143	--	--	--	--	--	--	--	--
Jack pine	833	303	264	78	--	188	--	--	--	--	--
White spruce	992	527	148	251	--	66	--	--	--	--	--
Black spruce	--	--	--	--	--	--	--	--	--	--	--
Balsam fir	1,289	608	396	69	--	216	--	--	--	--	--
Hemlock	8,360	2,623	1,774	1,161	680	948	361	491	201	121	--
Tamarack	60	--	--	--	60	--	--	--	--	--	--
Northern white-cedar	13,411	2,902	3,528	1,524	2,043	850	694	760	1,013	97	--
Other softwoods	--	--	--	--	--	--	--	--	--	--	--
Total	26,102	7,221	6,374	3,164	2,783	2,431	1,130	1,251	1,530	218	--
HARDWOODS											
Select white oaks	--	--	--	--	--	--	--	--	--	--	--
Select red oaks	2,266	--	236	377	386	112	628	209	318	--	--
Other red oaks	--	--	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--	--	--
Yellow birch	21,050	--	2,938	2,612	3,516	1,789	2,709	1,561	3,384	2,541	--
Hard maple	31,141	--	7,516	5,510	4,697	3,896	2,628	1,529	3,428	1,937	--
Soft maple	13,593	--	4,753	3,057	1,853	1,276	772	508	1,321	53	--
Beech	202	--	95	--	107	--	--	--	--	--	--
Ash	1,062	--	626	184	252	--	--	--	--	--	--
Balsam poplar	392	--	304	--	88	--	--	--	--	--	--
Cottonwood	--	--	--	--	--	--	--	--	--	--	--
Bigtooth aspen	2,568	--	1,015	865	169	263	164	92	--	--	--
Quaking aspen	12,396	--	4,881	2,912	2,623	1,100	703	177	--	--	--
Basswood	3,042	--	1,086	361	544	171	253	381	114	132	--
Yellow-poplar	--	--	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--	--	--
Black cherry	1,706	--	1,053	282	--	371	--	--	--	--	--
Butternut	--	--	--	--	--	--	--	--	--	--	--
Elm	3,832	--	1,923	880	106	492	230	--	201	--	--
Paper birch	3,969	--	2,067	444	426	340	332	281	--	79	--
Other hardwoods	57	--	--	57	--	--	--	--	--	--	--
Total	97,276	--	28,493	17,541	14,767	9,810	8,419	4,738	8,766	4,742	--
All species	123,378	7,221	34,867	20,705	17,550	12,241	9,550	5,988	10,296	4,960	--

Table 42.--Net volume of short-log trees on commercial forest land by species group and diameter class, Western Upper Peninsula, Michigan, 1980

(In thousand board feet)[1/]

Species group	All classes	Diameter class (inches at breast height) 9.0 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- 22.9	23.0- 28.9	29.0- 38.9	39-0+
SOFTWOODS											
White pine	3,350	1,093	453	275	--	502	211	--	816	--	--
Red pine	539	--	539	--	--	--	--	--	--	--	--
Jack pine	2,938	1,241	978	301	--	418	--	--	--	--	--
White spruce	3,904	2,332	556	821	--	195	--	--	--	--	--
Black spruce	--	--	--	--	--	--	--	--	--	--	--
Balsam fir	4,155	2,481	1,164	246	--	264	--	--	--	--	--
Hemlock	30,012	10,457	6,745	4,024	2,186	2,970	1,423	1,421	527	259	--
Tamarack	186	--	--	--	186	--	--	--	--	--	--
Northern white-cedar	36,766	11,179	10,616	3,887	4,722	1,737	1,660	1,354	1,531	80	--
Other softwoods	--	--	--	--	--	--	--	--	--	--	--
Total	81,850	28,783	21,051	9,554	7,094	6,086	3,294	2,775	2,874	339	--
HARDWOODS											
Select white oaks	--	--	--	--	--	--	--	--	--	--	--
Select red oaks	6,024	--	588	1,000	638	330	1,877	633	958	--	--
Other red oaks	--	--	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--	--	--
Yellow birch	82,879	--	15,866	12,895	14,964	7,094	10,069	6,504	8,906	6,581	--
Hard maple	83,883	--	21,317	15,853	12,889	10,946	6,203	3,380	9,230	4,065	--
Soft maple	41,121	--	14,664	8,348	5,461	3,994	2,738	1,575	4,176	165	--
Beech	507	--	242	--	265	--	--	--	--	--	--
Ash	2,686	--	1,807	491	388	--	--	--	--	--	--
Balsam poplar	998	--	745	--	253	--	--	--	--	--	--
Cottonwood	--	--	--	--	--	--	--	--	--	--	--
Bigtooth aspen	6,036	--	2,502	2,047	402	583	322	180	--	--	--
Quaking aspen	33,808	--	14,035	7,585	6,807	2,833	2,198	350	--	--	--
Basswood	9,112	--	2,729	918	1,493	413	1,033	1,802	343	381	--
Yellow-poplar	--	--	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--	--	--
Black cherry	4,970	--	3,162	755	--	1,053	--	--	--	--	--
Butternut	--	--	--	--	--	--	--	--	--	--	--
Elm	11,425	--	5,942	2,404	300	1,495	679	--	605	--	--
Paper birch	11,303	--	5,085	1,311	1,278	1,309	1,128	893	--	299	--
Other hardwoods	220	--	--	220	--	--	--	--	--	--	--
Total	294,972	--	88,684	53,827	45,138	30,050	26,247	15,317	24,218	11,491	--
All species	376,822	28,783	109,735	63,381	52,232	36,136	29,541	18,092	27,092	11,830	--

[1/]International 1/4-inch rule.

Table 43.--Net annual growth of growing stock on commercial forest land by softwoods and hardwoods, Western Upper Pennisula, Michigan, 1965 and 1979

(In million cubic feet)

Species	1965	1979
Softwoods	40.0	60.9
Hardwoods	98.9	133.8
All species	138.9	194.7

1/Figures have been adjusted from those published after the 1965 survey to conform to 1979 volumes because of changes in survey definitions and procedures.

Table 44.--Net annual growth of growing stock on commercial forest land by species group and county, Western Upper Peninsula, Michigan, 1979

(In thousand cubic feet)

Species group	All counties	County							
		Baraga	Dickinson	Gogebic	Houghton	Iron	Keweenaw	Marquette	Ontonagon
SOFTWOODS									
White pine	4,794	347	283	196	356	791	374	1,879	568
Red pine	3,030	113	190	420	508	364	24	902	509
Jack pine	3,999	208	118	263	731	301	--	1,986	392
White spruce	12,811	1,198	966	1,528	941	2,195	634	2,646	2,703
Black spruce	4,936	776	622	516	121	1,064	16	1,719	102
Balsam fir	16,748	1,824	1,395	2,284	1,012	3,217	403	4,209	2,404
Hemlock	6,260	1,209	41	1,228	699	457	5	1,444	1,177
Tamarack	841	153	149	95	9	259	3	170	3
Northern white-cedar	7,331	843	1,218	752	518	604	813	2,198	385
Other softwoods	86	--	--	4	1	2	--	76	3
Total	60,836	6,671	4,982	7,286	4,896	9,254	2,272	17,229	8,246
HARDWOODS									
Select white oaks	17	1	--	4	2	2	--	--	8
Select red oaks	2,599	100	117	264	254	179	373	1,124	188
Other red oaks	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--
Yellow birch	6,723	890	127	1,482	1,241	626	361	821	1,175
Hard maple	49,016	6,913	3,178	7,296	7,277	7,190	1,833	8,295	7,034
Soft maple	31,444	4,373	798	3,095	5,424	2,741	1,475	8,992	4,546
Beech	11	--	--	--	--	--	--	11	--
Ash	7,914	444	782	2,122	638	770	53	961	2,144
Balsam poplar	917	27	441	4	8	151	7	224	55
Cottonwood	6	--	--	--	--	6	--	--	--
Bigtooth aspen	2,295	101	162	196	205	360	8	640	623
Quaking aspen	15,664	841	2,478	1,875	1,500	2,896	316	2,068	3,690
Basswood	7,530	287	1,164	1,306	922	1,087	32	473	2,259
Yellow-poplar	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--
Black cherry	2,109	345	179	337	148	431	9	427	233
Butternut	--	--	--	--	--	--	--	--	--
Elm	-1,291	-38	166	-334	-242	-338	-22	-12	-471
Paper birch	8,873	507	1,221	610	571	1,933	576	2,565	890
Other hardwoods	8	--	--	3	--	--	--	--	5
Total	133,835	14,791	10,813	18,260	17,948	18,034	5,021	26,589	22,379
All species	194,671	21,462	15,795	25,546	22,844	27,288	7,293	43,818	30,625

Table 45.--Net annual growth of sawtimber on commercial forest land by species group and county, Western Upper Peninsula, Michigan, 1979

(In thousand board feet)[1/]

Species group	All counties	County							
		Baraga	Dickinson	Gogebic	Houghton	Iron	Keweenaw	Marquette	Ontonagon
SOFTWOODS									
White pine	25,759	1,901	1,350	1,032	2,327	4,779	2,019	9,029	3,322
Red pine	12,329	449	483	1,266	2,101	1,292	621	4,173	1,944
Jack pine	21,954	1,226	88	1,051	3,406	1,144	--	12,910	2,129
White spruce	53,710	6,795	4,135	7,857	6,012	8,674	3,263	8,249	8,725
Black spruce	5,499	277	853	349	-192	1,612	45	2,629	-74
Balsam fir	44,394	3,728	5,163	6,552	4,522	7,704	830	9,227	6,668
Hemlock	37,543	7,070	192	6,735	3,910	2,518	35	10,177	6,906
Tamarack	3,722	1,043	69	807	151	826	31	571	224
Northern white-cedar	32,141	3,472	4,053	4,953	2,680	4,620	3,255	6,656	2,452
Other softwoods	8	--	--	8	--	--	--	--	--
Total	237,059	25,961	16,386	30,610	24,917	33,169	10,099	63,621	32,296
HARDWOODS									
Select white oaks	104	7	--	23	12	10	--	--	52
Select red oaks	15,496	273	1,116	1,600	2,016	503	2,154	7,455	379
Other red oaks	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--
Yellow birch	19,639	4,590	140	1,471	5,882	1,988	1,521	2,414	1,633
Hard maple	139,326	24,066	5,119	15,433	22,959	20,437	6,324	27,446	17,542
Soft maple	79,450	15,687	2,581	7,973	14,100	9,248	4,255	17,277	8,329
Beech	8	--	--	--	--	--	--	8	--
Ash	31,615	2,267	2,235	11,297	2,879	1,998	578	3,289	7,072
Balsam poplar	4,484	59	2,715	19	19	198	--	1,269	205
Cottonwood	27	--	--	--	--	27	--	--	--
Bigtooth aspen	17,011	398	1,598	1,738	2,592	1,567	-7	4,390	4,735
Quaking aspen	93,060	3,927	6,374	14,885	10,716	14,609	2,217	14,313	26,019
Basswood	29,144	597	5,860	5,127	2,289	4,519	146	2,565	8,041
Yellow-poplar	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--
Black cherry	4,548	1,931	30	750	68	99	--	1,622	48
Butternut	--	--	--	--	--	--	--	--	--
Elm	1,630	-119	860	1,405	853	-105	-139	-198	-927
Paper birch	28,787	3,818	2,248	1,904	4,888	6,483	2,269	5,876	1,301
Other hardwoods	16	--	--	--	--	--	--	--	16
Total	464,345	57,501	30,876	63,625	69,273	61,581	19,318	87,726	74,445
All species	701,404	83,462	47,262	94,235	94,190	94,750	29,417	151,347	106,741

[1/] International 1/4-inch rule.

Table 46.--Net annual growth of growing stock on commercial forest land by species group and ownership class, Western Upper Peninsula, Michigan, 1979

(In thousand cubic feet)

Species group	All owners	Ownership class									
		National Forest	Bureau of Land Mgmt.	Misc. federal	Indian	State	County & municipal	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.
SOFTWOODS											
White pine	4,794	1,010	--	--	--	816	23	1,020	163	919	843
Red pine	3,030	1,630	--	--	--	438	--	209	35	191	527
Jack pine	3,999	1,560	--	--	--	946	370	363	--	229	531
White spruce	12,811	2,363	--	6	99	1,957	140	4,146	477	1,754	1,869
Black spruce	4,936	645	--	1	--	967	115	1,450	131	350	1,277
Balsam fir	16,748	3,452	--	36	2	2,327	139	4,860	846	1,610	3,476
Hemlock	6,260	902	--	--	47	373	62	2,586	220	813	1,257
Tamarack	841	5	--	--	--	466	8	148	28	111	75
Northern white-cedar	7,331	700	--	--	2	1,830	106	2,313	298	991	1,091
Other softwoods	86	8	--	--	--	--	--	--	--	2	76
Total	60,836	12,275	--	43	150	10,120	963	17,095	2,198	6,970	11,022
HARDWOODS											
Select white oak	17	17	--	--	--	--	--	--	--	--	--
Select red oaks	2,599	135	--	--	5	434	--	671	94	585	675
Other red oaks	--	--	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--	--	--
Yellow birch	6,723	977	--	2	43	507	35	2,062	262	1,746	1,089
Hard maple	49,016	7,147	--	--	156	4,185	1,389	16,691	2,483	8,127	8,838
Soft maple	31,444	5,436	--	--	207	3,443	320	7,874	1,858	5,005	7,301
Beech	11	--	--	--	--	5	--	6	--	--	--
Ash	7,914	1,764	--	--	12	778	407	2,391	400	1,119	1,043
Balsam poplar	917	18	--	--	--	315	--	267	42	50	225
Cottonwood	6	--	--	--	--	--	--	--	6	--	--
Bigtooth aspen	2,295	743	--	--	48	342	30	121	44	489	478
Quaking aspen	15,664	2,783	--	--	78	2,775	389	2,716	1,081	2,349	3,493
Basswood	7,530	1,570	--	--	2	721	162	1,703	529	1,314	1,529
Yellow-poplar	--	--	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--	--	--
Black cherry	2,109	331	--	--	--	242	66	691	113	291	375
Butternut	--	--	--	--	--	--	--	--	--	--	--
Elm	-1,291	-519	--	--	-6	-75	-30	-322	-190	-42	-107
Paper birch	8,873	1,144	--	5	--	1,531	69	1,948	477	1,200	2,499
Other hardwoods	8	--	--	--	--	--	--	--	--	5	3
Total	133,835	21,546	--	7	545	15,203	2,837	36,819	7,199	22,238	27,441
All species	194,671	33,821	--	50	695	25,323	3,800	53,914	9,397	29,208	38,463

Table 47.--Net annual growth of sawtimber on commercial forest land by species group and ownership class, Western Upper Peninsula, Michigan, 1979

(In thousand board feet)[1/]

Species group	All owners	Ownership class									
		National Forest	Bureau of Land Mgmt.	Misc. federal	Indian	State	County & municipal	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.
SOFTWOODS											
White pine	25,759	5,443	--	--	--	4,779	88	4,843	754	5,141	4,711
Red pine	12,329	5,967	--	--	--	2,655	--	719	72	1,511	1,405
Jack pine	21,954	7,661	--	--	--	8,409	582	993	--	2,224	2,085
White spruce	53,710	13,900	--	546	52	9,357	680	11,201	1,885	9,574	6,515
Black spruce	5,499	-160	--	--	--	1,962	470	2,770	559	-134	32
Balsam fir	44,394	8,114	--	127	--	7,606	916	11,311	1,330	4,451	10,539
Hemlock	37,543	4,813	--	--	240	2,005	236	18,531	1,150	4,923	5,645
Tamarack	3,722	1,443	--	--	--	1,069	34	903	7	149	117
Northern white-cedar	32,141	6,161	--	--	11	4,793	357	10,270	613	5,082	4,854
Other softwoods	8	--	--	--	--	--	--	--	--	8	--
Total	237,059	53,342	--	673	303	42,635	3,363	61,541	6,370	32,929	35,903
HARDWOODS											
Select white oaks	104	104	--	--	--	--	--	--	--	--	--
Select red oaks	15,496	575	--	--	30	1,656	--	5,188	976	2,782	4,289
Other red oaks	--	--	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--	--	--
Yellow birch	19,639	805	--	13	579	744	-128	8,788	2,003	4,367	2,468
Hard maple	139,326	17,920	--	--	180	9,410	2,270	55,991	7,215	22,291	24,049
Soft maple	79,450	15,132	--	--	215	7,478	956	22,039	5,970	9,773	17,887
Beech	8	--	--	--	--	8	--	--	--	--	--
Ash	31,615	7,854	--	--	48	3,989	2,329	7,504	243	5,707	3,941
Balsam poplar	4,484	88	--	--	--	2,427	--	1,296	87	81	505
Cottonwood	27	--	--	--	--	--	--	--	27	--	--
Bigtooth aspen	17,011	7,736	--	--	58	623	65	998	793	2,208	4,530
Quaking aspen	93,060	27,690	--	--	115	12,623	4,507	16,283	3,517	11,755	16,570
Basswood	29,144	6,858	--	--	16	5,566	753	6,043	2,144	3,551	4,213
Yellow-poplar	--	--	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--	--	--
Black cherry	4,548	118	--	--	--	66	9	2,678	816	73	788
Butternut	--	--	--	--	--	--	--	--	--	--	--
Elm	1,630	-2,077	--	--	-19	1,836	-250	3,791	-214	-662	-775
Paper birch	28,787	8,104	--	12	--	4,351	49	5,996	1,449	4,572	4,254
Other hardwoods	16	--	--	--	--	--	--	--	--	16	--
Total	464,345	90,907	--	25	1,222	50,777	10,560	136,595	25,026	66,514	82,719
All species	701,404	144,249	--	698	1,525	93,412	13,923	198,136	31,396	99,443	118,622

[1/] International 1/4-inch rule.

Table 48.--Net annual growth of growing stock on commercial forest land by species group and forest type, Western Upper Peninsula, Michigan, 1979

(In thousand cubic feet)

Species group	All types	Forest type: Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
SOFTWOODS								
White pine	4,794	54	233	1,490	533	117	121	88
Red pine	3,030	463	1,695	96	65	2	142	1
Jack pine	3,999	3,031	71	7	24	71	255	--
White spruce	12,811	12	44	226	2,968	2,006	118	256
Black spruce	4,936	4	11	27	665	28	3,449	38
Balsam fir	16,748	33	11	-6	6,039	133	449	-465
Hemlock	6,260	--	--	9	115	--	14	9
Tamarack	841	--	--	-1	80	-1	390	-177
Northern white-cedar	7,331	--	--	15	843	36	411	3,651
Other softwoods	86	--	8	--	--	--	76	--
Total	60,836	3,597	2,073	1,863	11,332	2,392	5,425	3,401
HARDWOODS								
Select white oaks	17	--	--	--	--	--	--	--
Select red oaks	2,599	47	34	89	23	--	--	--
Other red oaks	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--
Yellow birch	6,723	--	--	2	121	4	12	131
Hard maple	49,016	--	49	136	147	39	10	139
Soft maple	31,444	8	40	280	1,039	127	219	208
Beech	11	--	--	--	--	--	--	--
Ash	7,914	--	--	--	226	--	69	214
Balsam poplar	917	--	2	--	105	1	5	44
Cottonwood	6	--	--	--	--	--	--	--
Bigtooth aspen	2,295	11	49	--	-30	--	6	-18
Quaking aspen	15,664	105	101	213	564	216	108	101
Basswood	7,530	--	--	14	7	--	--	--
Yellow-poplar	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--
Black cherry	2,109	--	--	--	100	6	8	4
Butternut	--	--	--	--	--	--	--	--
Elm	-1,291	--	--	-2	-36	3	--	54
Paper birch	8,873	6	59	101	839	36	321	118
Other hardwoods	8	--	--	--	--	--	--	--
Total	133,835	177	334	833	3,105	432	758	995
All species	194,671	3,774	2,407	2,696	14,437	2,824	6,183	4,396

(Table 48 continued on next page)

Table 48 continued)

Species group	Forest type							
	Tamarack	Oak-hickory	Elm-ash-soft maple	Maple-birch	Aspen	Paper birch	Exotic	Non-stocked
OFTWOODS								
White pine	8	40	54	1,329	574	149	--	4
Red pine	--	29	--	23	463	51	--	--
Jack pine	--	--	--	144	298	90	--	8
White spruce	53	5	414	3,599	2,595	515	--	--
Black spruce	211	2	177	89	227	8	--	--
Balsam fir	38	3	396	5,903	3,537	677	--	--
Hemlock	--	--	279	5,718	97	19	--	--
Tamarack	501	--	5	--	40	4	--	--
Northern white-cedar	91	--	570	1,433	168	113	--	--
Other softwoods	--	--	--	2	--	--	--	--
Total	902	79	1,895	18,240	7,999	1,626	--	12
ARDWOODS								
Select white oaks	--	--	--	--	17	--	--	--
Select red oaks	--	673	20	1,228	385	100	--	--
Other red oaks	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--
Yellow birch	--	5	250	5,955	133	110	--	--
Hard maple	--	91	646	44,687	2,504	568	--	--
Soft maple	--	104	1,634	22,122	3,877	1,786	--	--
Beech	--	--	--	11	--	--	--	--
Ash	--	6	2,775	3,987	589	48	--	--
Balsam poplar	3	--	27	105	603	22	--	--
Cottonwood	--	--	--	--	6	--	--	--
Bigtooth aspen	--	53	--	122	2,007	95	--	--
Quaking aspen	10	9	76	3,165	10,788	199	--	9
Basswood	--	--	68	7,181	247	13	--	--
Yellow-poplar	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--
Black cherry	--	--	18	1,607	343	23	--	--
Butternut	--	--	--	--	--	--	--	--
Elm	--	--	-161	-1,318	69	100	--	--
Paper birch	12	48	101	1,316	2,425	3,484	--	7
Other hardwoods	--	--	5	3	--	--	--	--
Total	25	989	5,459	90,171	23,993	6,548	--	16
11 species	927	1,068	7,354	108,411	31,992	8,174	--	28

Table 49.--Net annual growth of sawtimber on commercial forest land by species group and forest type, Western Upper Peninsula, Michigan, 1979

(In thousand board feet)[1/]

Species group	All types	Forest type: Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
SOFTWOODS								
White pine	25,759	253	1,537	7,664	3,130	524	625	547
Red pine	12,329	768	9,201	476	280	12	399	5
Jack pine	21,954	18,038	524	50	29	26	286	--
White spruce	53,710	62	53	634	15,341	3,382	396	341
Black spruce	5,499	3	--	916	2,510	543	880	19
Balsam fir	44,394	185	529	15	15,282	556	-524	-1,516
Hemlock	37,543	--	--	53	953	--	76	43
Tamarack	3,722	--	--	-9	714	-18	1,626	-202
Northern white-cedar	32,141	--	--	29	4,718	80	3,147	12,123
Other softwoods	8	--	--	--	--	--	--	--
Total	237,059	19,309	11,844	9,828	42,957	5,105	6,911	11,360
HARDWOODS								
Select white oaks	104	--	--	--	--	--	--	--
Select red oaks	15,496	44	148	15	--	--	--	--
Other red oaks	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--
Yellow birch	19,639	--	--	--	1,416	--	34	199
Hard maple	139,326	--	--	71	245	33	25	114
Soft maple	79,450	--	9	134	6,891	--	31	311
Beech	8	--	--	--	--	--	--	--
Ash	31,615	--	--	--	139	--	1,101	105
Balsam poplar	4,484	--	9	--	129	--	19	-37
Cottonwood	27	--	--	--	--	--	--	--
Bigtooth aspen	17,011	23	666	--	-176	--	--	-100
Quaking aspen	93,060	--	56	121	5,952	754	763	-24
Basswood	29,144	--	--	--	10	--	--	--
Yellow-poplar	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--
Black cherry	4,548	--	--	--	18	--	--	4
Butternut	--	--	--	--	--	--	--	--
Elm	1,630	--	--	--	683	-6	--	-9
Paper birch	28,787	13	53	743	352	15	1,755	664
Other hardwoods	16	--	--	--	--	--	--	--
Total	464,345	80	941	1,084	15,659	796	3,728	1,227
All species	701,404	19,389	12,785	10,912	58,616	5,901	10,639	12,587

(Table 49 continued on next page)

[1/]International 1/4-inch rule.

(Table 49 continued)

Species group	Forest type							
	Tamarack	Oak-hickory	Elm-ash-soft maple	Maple-birch	Aspen	Paper birch	Exotic	Non-stocked
SOFTWOODS								
White pine	52	205	279	6,701	3,469	773	--	--
Red pine	--	141	--	92	700	255	--	--
Jack pine	--	--	--	68	2,121	812	--	--
White spruce	--	28	1,637	18,492	11,806	1,538	--	--
Black spruce	33	--	441	-314	514	-46	--	--
Balsam fir	33	--	749	17,971	10,442	672	--	--
Hemlock	--	--	862	35,320	156	80	--	--
Tamarack	1,401	--	36	--	169	5	--	--
Northern white-cedar	961	--	1,951	7,065	1,088	979	--	--
Other softwoods	--	--	--	8	--	--	--	--
Total	2,480	374	5,955	85,403	30,465	5,068	--	--
HARDWOODS								
Select white oaks	--	--	--	--	104	--	--	--
Select red oaks	--	3,852	19	8,616	2,060	742	--	--
Other red oaks	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--
Yellow birch	--	8	1,988	15,926	33	35	--	--
Hard maple	--	583	380	136,424	1,308	143	--	--
Soft maple	--	15	3,361	64,098	3,719	881	--	--
Beech	--	--	--	8	--	--	--	--
Ash	--	33	14,146	14,888	1,162	41	--	--
Balsam poplar	7	--	23	684	3,020	630	--	--
Cottonwood	--	--	--	--	27	--	--	--
Bigtooth aspen	--	58	--	1,652	14,816	72	--	--
Quaking aspen	11	13	-174	25,325	58,745	1,518	--	--
Basswood	--	--	657	28,396	81	--	--	--
Yellow-poplar	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--
Black cherry	--	--	12	4,453	61	--	--	--
Butternut	--	--	--	--	--	--	--	--
Elm	--	--	-510	915	579	-22	--	--
Paper birch	--	54	103	7,490	3,733	13,812	--	--
Other hardwoods	--	--	16	--	--	--	--	--
Total	18	4,616	20,021	308,875	89,448	17,852	--	--
11 species	2,498	4,990	25,976	394,278	119,913	22,920	--	--

Table 50.--Net annual growth of growing stock on commercial forest land by forest type and stand-age class, Western Upper Peninsula, Michigan, 1979

(In thousand cubic feet)

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	3,774	--	79	598	789	921	1,077	184	45	88	-7	--	--	--
Red pine	2,407	--	170	520	712	--	71	264	65	165	54	335	51	--
White pine	2,696	--	--	177	75	135	--	616	134	779	257	192	227	104
Balsam fir	14,437	682	735	668	1,888	2,814	2,734	1,515	1,411	623	381	799	8	179
White spruce	2,824	118	43	--	1,456	164	393	129	87	--	--	434	--	--
Black spruce	6,183	611	612	936	510	783	1,416	610	480	--	33	81	98	13
Northern white-cedar	4,396	22	148	150	100	397	296	476	663	1,131	336	563	136	-22
Tamarack	927	76	69	180	4	229	222	15	--	--	107	--	--	25
Oak-hickory	1,068	--	--	53	173	225	--	220	--	70	121	146	60	--
Elm-ash-soft maple	7,354	167	776	205	634	693	879	686	528	630	230	553	650	723
Maple-birch	108,411	2,715	2,898	1,976	7,587	20,142	19,512	7,578	7,864	8,225	8,876	13,610	5,738	1,690
Aspen	31,992	2,508	1,735	1,123	5,086	7,633	7,673	2,337	2,361	1,033	232	271	--	--
Paper birch	8,174	109	264	99	672	1,038	3,111	1,473	620	387	128	--	234	39
Exotic	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nonstocked	28	11	8	--	9	--	--	--	--	--	--	--	--	--
All types	194,671	7,019	7,537	6,685	19,695	35,174	37,384	16,103	14,258	13,131	10,748	16,984	7,202	2,751

Table 51.--Net annual growth of sawtimber on commercial forest land by forest type and stand-age class, Western Upper Peninsula, Michigan, 1979

(In thousand board feet)[1/]

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	19,389	--	172	2,261	3,811	2,614	8,559	1,634	433	30	-125	--	--	--
Red pine	12,785	--	278	292	5,062	--	853	1,029	666	1,218	799	2,489	99	--
White pine	10,912	--	--	95	140	77	--	2,959	529	3,124	1,751	884	916	437
Balsam fir	58,616	991	1,929	2,756	6,784	9,819	8,809	7,945	14,212	2,311	1,518	1,335	-103	310
White spruce	5,901	283	75	--	798	964	546	1,556	283	--	--	1,396	--	--
Black spruce	10,639	202	1,058	747	1,161	677	787	3,024	114	--	750	1,061	1,329	-271
Northern white-cedar	12,587	24	63	97	295	2,109	877	2,511	957	1,712	243	1,805	1,864	30
Tamarack	2,498	977	202	600	--	45	144	--	--	--	397	--	--	133
Oak-hickory	4,990	--	--	75	120	951	--	759	--	1,367	1,028	490	200	--
Elm-ash-soft maple	25,976	194	1,425	634	1,717	573	3,700	1,379	1,171	4,564	1,948	3,273	2,196	3,202
Maple-birch	394,278	6,139	6,280	3,860	16,213	58,308	52,573	20,950	35,707	46,562	38,145	68,049	30,701	10,791
Aspen	119,913	5,251	3,611	1,107	12,398	29,545	36,497	13,073	9,863	5,523	1,100	1,945	--	--
Paper birch	22,920	119	187	23	918	1,296	11,135	2,705	1,470	1,162	3,556	--	278	71
Exotic	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All types	701,404	14,180	15,280	12,547	49,417	106,978	124,480	59,524	65,405	67,573	51,110	82,727	37,480	14,703

[1/] International 1/4-inch rule.

Table 52.--Net annual growth of growing stock on commercial forest land by forest type, stand-size class, and basal-area class, Western Upper Peninsula, Michigan, 1979

(In thousand cubic feet)

Forest type and stand-size class	All classes	Basal area class (square feet per acre)													
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-150	151-180	181+
Jack pine															
Sawtimber	1,372	--	--	--	--	102	451	79	268	210	113	149	--	--	--
Poletimber	2,298	--	50	--	--	28	526	205	105	148	103	--	1,088	--	45
Sapling & seedling	104	--	--	11	51	16	26	--	--	--	--	--	--	--	--
All stands	3,774	--	50	11	51	146	1,003	284	373	358	216	149	1,088	--	45
Red pine															
Sawtimber	1,004	--	--	--	--	--	--	--	125	51	65	--	505	258	--
Poletimber	1,351	--	--	--	--	118	109	--	--	49	111	--	410	554	--
Sapling & seedling	52	--	--	34	--	--	18	--	--	--	--	--	--	--	--
All stands	2,407	--	--	34	--	118	127	--	125	100	176	--	915	812	--
White pine															
Sawtimber	2,241	--	--	--	30	--	--	56	216	--	330	366	442	801	--
Poletimber	455	--	--	--	--	--	--	--	252	135	68	--	--	--	--
Sapling & seedling	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All stands	2,696	--	--	--	30	--	--	56	468	135	398	366	442	801	--
Balsam fir															
Sawtimber	3,026	--	--	--	--	--	64	125	--	394	409	293	1,683	--	58
Poletimber	9,501	--	--	29	23	23	33	1,030	640	427	891	3,172	1,664	1,311	258
Sapling & seedling	1,910	2	85	11	255	267	123	534	120	123	206	123	36	25	--
All stands	14,437	2	85	40	278	290	220	1,689	760	944	1,506	3,588	3,383	1,336	316
White spruce															
Sawtimber	648	--	--	--	--	62	--	66	87	68	--	218	147	--	--
Poletimber	2,015	--	--	--	--	35	--	--	276	143	46	--	1,386	129	--
Sapling & seedling	161	--	--	82	--	36	43	--	--	--	--	--	--	--	--
All stands	2,824	--	--	82	--	133	43	66	363	211	46	218	1,533	129	--
Black spruce															
Sawtimber	128	--	--	--	--	--	--	--	44	--	--	--	84	--	--
Poletimber	3,681	--	--	--	66	107	297	80	46	455	226	1,268	840	-15	311
Sapling & seedling	2,374	3	14	17	224	403	212	500	123	36	499	188	155	--	--
All stands	6,183	3	14	17	290	510	509	580	213	491	725	1,456	1,079	-15	311
Northern white-cedar															
Sawtimber	1,060	--	--	--	--	31	12	41	90	--	134	527	181	-38	82
Poletimber	2,938	--	--	--	--	--	--	24	115	54	332	507	651	579	676
Sapling & seedling	398	--	--	6	6	106	--	10	--	54	--	38	170	8	--
All stands	4,396	--	--	6	6	137	12	75	205	108	466	1,072	1,002	549	758

(Table 52 continued on next page)

(Table 52 continued)

Forest type and stand-size class	All classes	Basal area class (square feet per acre)													
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-150	151-180	181+
Tamarack															
Sawtimber	123	--	--	14	--	25	--	--	--	--	--	--	84	--	--
Poletimber	266	--	--	--	83	--	24	39	120	--	--	--	--	--	--
Sapling & seedling	538	3	32	31	77	--	--	80	143	172	--	--	--	--	--
All stands	927	3	32	45	160	25	24	119	263	172	--	--	84	--	--
Oak-hickory															
Sawtimber	396	--	--	--	--	--	--	--	--	116	86	70	--	124	--
Poletimber	619	--	--	--	--	--	--	--	--	--	--	387	232	--	--
Sapling & seedling	53	--	--	--	--	--	--	--	--	--	--	53	--	--	--
All stands	1,068	--	--	--	--	--	--	--	--	116	86	510	232	124	--
Elm-ash-soft maple															
Sawtimber	2,617	--	--	--	17	--	23	--	--	157	170	393	1,154	560	143
Poletimber	3,613	--	--	29	144	19	--	180	240	193	833	417	464	941	153
Sapling & seedling	1,124	--	37	--	30	59	152	505	130	--	184	27	--	--	--
All stands	7,354	--	37	29	191	78	175	685	370	350	1,187	837	1,618	1,501	296
Maple-birch															
Sawtimber	45,303	--	--	--	20	160	314	722	2,008	1,555	5,951	11,357	15,537	6,374	1,305
Poletimber	56,409	--	--	--	--	648	536	3,023	3,552	3,562	6,597	12,752	19,331	6,110	298
Sapling & seedling	6,699	2	67	52	312	837	727	1,141	1,028	1,091	298	751	393	--	--
All stands	108,411	2	67	52	332	1,645	1,577	4,886	6,588	6,208	12,846	24,860	35,261	12,484	1,603
Aspen															
Sawtimber	5,165	--	124	--	52	118	339	335	487	836	230	708	1,038	898	--
Poletimber	22,084	--	--	37	285	658	890	1,722	1,973	1,825	2,420	4,872	5,163	1,530	709
Sapling & seedling	4,743	106	318	596	705	1,252	527	422	256	22	238	301	--	--	--
All stands	31,992	106	442	633	1,042	2,028	1,756	2,479	2,716	2,683	2,888	5,881	6,201	2,428	709
Paper birch															
Sawtimber	724	--	--	--	35	--	--	--	--	52	43	434	150	--	10
Poletimber	6,978	--	--	--	--	116	115	127	464	654	422	717	3,747	616	--
Sapling & seedling	472	--	2	33	13	77	--	53	49	102	--	143	--	--	--
All stands	8,174	--	2	33	48	193	115	180	513	808	465	1,294	3,897	616	10
Exotic															
Sawtimber	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Poletimber	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sapling & seedling	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All stands	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nonstocked	28	15	13	--	--	--	--	--	--	--	--	--	--	--	--
All types															
Sawtimber	63,807	--	124	14	154	498	1,203	1,424	3,325	3,439	7,531	14,515	21,005	8,977	1,598
Poletimber	112,208	--	50	95	601	1,752	2,530	6,430	7,783	7,645	12,049	24,092	34,976	11,755	2,450
Sapling & seedling	18,628	116	555	873	1,673	3,053	1,828	3,245	1,849	1,600	1,425	1,624	754	33	--
Nonstocked	28	15	13	--	--	--	--	--	--	--	--	--	--	--	--
All stands	194,671	131	742	982	2,428	5,303	5,561	11,099	12,957	12,684	21,005	40,231	56,735	20,765	4,048

Table 53.--Net annual growth of sawtimber on commercial forest land by forest type, stand-size class, and basal-area class, Western Upper Peninsula, Michigan, 1979

(In thousand board feet)[1/]

Forest type and stand-size class	All classes	Basal area class (square feet per acre)													
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-150	151-180	181+
Jack pine															
Sawtimber	9,768	--	--	--	--	396	5,429	173	646	1,494	810	820	--	--	--
Poletimber	9,414	--	921	--	--	--	2,354	910	39	650	1,156	--	2,901	--	483
Sapling & seedling	207	--	--	--	103	79	25	--	--	--	--	--	--	--	--
All stands	19,389	--	921	--	103	475	7,808	1,083	685	2,144	1,966	820	2,901	--	483
Red pine															
Sawtimber	7,153	--	--	--	--	--	--	--	1,653	99	666	--	2,646	2,089	--
Poletimber	5,565	--	--	--	--	211	1,596	--	--	491	107	--	185	2,975	--
Sapling & seedling	67	--	--	--	--	--	67	--	--	--	--	--	--	--	--
All stands	12,785	--	--	--	--	211	1,663	--	1,653	590	773	--	2,831	5,064	--
White pine															
Sawtimber	10,476	--	--	--	113	--	--	229	1,046	--	1,517	1,629	1,386	4,556	--
Poletimber	436	--	--	--	--	--	--	--	235	77	124	--	--	--	--
Sapling & seedling	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All stands	10,912	--	--	--	113	--	--	229	1,281	77	1,641	1,629	1,386	4,556	--
Balsam fir															
Sawtimber	14,879	--	--	--	--	--	750	172	--	2,956	1,060	1,674	7,850	--	417
Poletimber	38,282	--	--	33	21	399	31	5,846	2,351	710	2,995	9,746	9,083	6,027	1,040
Sapling & seedling	5,455	10	68	60	1,822	176	553	2,256	61	97	228	36	88	--	--
All stands	58,616	10	68	93	1,843	575	1,334	8,274	2,412	3,763	4,283	11,456	17,021	6,027	1,457
White spruce															
Sawtimber	2,255	--	--	--	--	288	--	288	283	131	--	819	446	--	--
Poletimber	3,289	--	--	--	--	65	--	--	660	79	124	--	805	1,556	--
Sapling & seedling	357	--	--	113	--	169	75	--	--	--	--	--	--	--	--
All stands	5,901	--	--	113	--	522	75	288	943	210	124	819	1,251	1,556	--
Black spruce															
Sawtimber	1,511	--	--	--	--	--	--	--	150	--	--	--	1,361	--	--
Poletimber	7,060	--	--	--	85	46	184	155	48	25	876	1,763	3,052	806	20
Sapling & seedling	2,068	--	--	--	70	1,123	80	60	61	77	597	--	--	--	--
All stands	10,639	--	--	--	155	1,169	264	215	259	102	1,473	1,763	4,413	806	20
Northern white-cedar															
Sawtimber	4,298	--	--	--	--	47	52	151	110	--	365	991	1,271	401	910
Poletimber	8,067	--	--	--	--	--	--	13	64	99	1,237	571	1,905	1,295	2,883
Sapling & seedling	222	--	--	18	--	--	--	7	--	87	--	61	46	3	--
All stands	12,587	--	--	18	--	47	52	171	174	186	1,602	1,623	3,222	1,699	3,793

(Table 53 continued on next page)

(Table 53 continued)

Forest type and stand-size class	All classes	Basal area class (square feet per acre) 0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-150	151-180	181+
Tamarack															
Sawtimber	575	--	--	56	--	133	--	--	--	--	--	--	386	--	--
Poletimber	144	--	--	--	6	--	50	7	81	--	--	--	--	--	--
Sapling & seedling	1,779	--	912	65	699	--	--	--	8	95	--	--	--	--	--
All stands	2,498	--	912	121	705	133	50	7	89	95	--	--	386	--	--
Oak-hickory															
Sawtimber	3,085	--	--	--	--	--	--	--	--	558	247	1,367	--	913	--
Poletimber	1,830	--	--	--	--	--	--	--	--	--	--	1,066	764	--	--
Sapling & seedling	75	--	--	--	--	--	--	--	--	--	--	75	--	--	--
All stands	4,990	--	--	--	--	--	--	--	--	558	247	2,508	764	913	--
Elm-ash-soft maple															
Sawtimber	13,904	--	--	--	33	--	83	--	--	670	862	3,017	5,191	3,440	608
Poletimber	10,335	--	--	--	517	-7	--	720	130	99	2,642	1,963	1,523	2,093	655
Sapling & seedling	1,737	--	30	--	113	54	7	25	161	--	1,340	7	--	--	--
All stands	25,976	--	30	--	663	47	90	745	291	769	4,844	4,987	6,714	5,533	1,263
Maple-birch															
Sawtimber	233,516	--	--	--	63	1,190	744	3,091	9,400	7,769	28,376	58,201	82,972	36,703	5,007
Poletimber	145,684	--	--	--	--	1,330	128	4,799	8,468	6,639	17,299	30,332	56,883	19,304	502
Sapling & seedling	15,078	9	22	745	757	420	1,143	3,179	662	3,208	1,867	2,949	117	--	--
All stands	394,278	9	22	745	820	2,940	2,015	11,069	18,530	17,616	47,542	91,482	139,972	56,007	5,509
Aspen															
Sawtimber	29,205	--	73	--	161	871	1,256	3,255	5,096	2,910	547	5,380	6,721	2,935	--
Poletimber	81,735	--	--	92	67	879	2,534	10,594	6,281	7,684	8,159	21,737	12,470	5,571	5,667
Sapling & seedling	8,973	--	705	952	4,184	839	1,032	542	458	24	105	132	--	--	--
All stands	119,913	--	778	1,044	4,412	2,589	4,822	14,391	11,835	10,618	8,811	27,249	19,191	8,506	5,667
Paper birch															
Sawtimber	5,671	--	--	--	141	--	--	--	--	119	528	1,698	3,141	--	44
Poletimber	16,919	--	--	--	--	41	14	82	861	153	231	1,609	10,255	3,673	--
Sapling & seedling	330	--	--	59	43	--	--	116	61	43	--	8	--	--	--
All stands	22,920	--	--	59	184	41	14	198	922	315	759	3,315	13,396	3,673	44
Exotic															
Sawtimber	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Poletimber	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sapling & seedling	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All stands	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All types															
Sawtimber	336,296	--	73	56	511	2,925	8,314	7,359	18,384	16,706	34,978	75,596	113,371	51,037	6,986
Poletimber	328,760	--	921	125	696	2,964	6,891	23,126	19,218	16,706	34,950	68,787	99,826	43,300	11,250
Spling & seedling	36,348	19	1,737	2,012	7,791	2,860	2,982	6,185	1,472	3,631	4,137	3,268	251	3	--
Nonstocked	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All stands	701,404	19	2,731	2,193	8,998	8,749	18,187	36,670	39,074	37,043	74,065	147,651	213,448	94,340	18,236

1/International 1/4-inch rule.

Table 54.--Timber removals[1/] from growing stock on commercial forest land by species group and county, Western Upper Peninsula, Michigan, 1979

(In thousand cubic feet)

Species group	All counties	County							
		Baraga	Dickinson	Gogebic	Houghton	Iron	Keweenaw	Marquette	Ontonagon
SOFTWOODS									
White pine	2,409	171	243	332	440	264	109	649	201
Red pine	1,945	125	227	209	250	379	22	548	185
Jack pine	2,889	44	137	133	497	529	1	1,379	169
White spruce	1,100	84	81	60	71	389	35	277	103
Black spruce	921	73	114	47	29	323	20	298	17
Balsam fir	3,816	313	387	240	132	1320	30	1,107	287
Hemlock	3,868	746	93	712	284	456	97	957	523
Tamarack	79	5	11	9	5	25	--	22	2
Northern white-cedar	976	60	173	50	52	78	75	459	29
Other softwoods	--	--	--	--	--	--	--	--	--
Total	18,003	1,621	1,466	1,792	1,760	3,763	389	5,696	1,516
HARDWOODS									
Select white oaks	23	--	6	--	15	--	--	1	1
Select red oaks	1,417	63	56	112	335	86	266	406	93
Other red oaks	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--
Yellow birch	3,224	491	52	423	429	546	173	556	554
Hard maple	14,549	1,921	452	1,813	1,949	1,825	716	3,541	2,332
Soft maple	6,075	840	485	418	806	763	292	1,619	852
Beech	101	1	3	--	--	--	--	97	--
Ash	547	39	67	109	30	66	18	47	171
Balsam poplar	651	64	269	--	10	13	1	289	5
Cottonwood	--	--	--	--	--	--	--	--	--
Bigtooth aspen	3,792	491	689	305	319	593	5	929	461
Quaking aspen	22,510	1,999	4,901	3,191	2,157	4,010	56	1,837	4,359
Basswood	1,153	74	83	190	133	190	27	175	281
Yellow-poplar	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--
Butternut	--	--	--	--	--	--	--	--	--
Elm	3,351	434	225	391	274	1,042	47	440	498
Paper birch	2,574	228	645	94	198	361	34	850	164
Other hardwoods[2/]	332	60	16	33	36	107	1	42	37
Total	60,299	6,705	7,949	7,079	6,691	9,602	1,636	10,829	9,808
All species	78,302	8,326	9,415	8,871	8,451	13,365	2,025	16,525	11,324

[1/] Removals in 1979 are trend-level removals.
[2/] Includes black cherry.

Table 55.--Timber removals[1/] from sawtimber on commercial forest land by species group and county, Western Upper Peninsula, Michigan, 1979

(In thousand board feet)[2/]

Species group	All counties	County							
		Baraga	Dickinson	Gogebic	Houghton	Iron	Keweenaw	Marquette	Ontonagon
SOFTWOODS									
White pine	12,010	772	1,294	1,791	2,452	1,199	559	2,998	945
Red pine	7,770	361	1,131	903	1,224	1,365	110	2,037	639
Jack pine	7,680	93	573	530	1,540	1,289	2	3,180	473
White spruce	4,233	305	393	225	228	1,507	133	1,152	290
Black spruce	956	60	105	39	32	352	34	322	12
Balsam fir	9,512	767	988	540	302	3,432	41	2,757	685
Hemlock	13,748	2,707	239	2,853	964	1,429	389	3,459	1,708
Tamarack	147	6	16	26	5	47	--	42	5
Northern white-cedar	2,130	167	468	125	132	194	139	830	75
Other softwoods	--	--	--	--	--	--	--	--	--
Total	58,186	5,238	5,207	7,032	6,879	10,814	1,407	16,777	4,832
HARDWOODS									
Select white oaks	94	--	3	--	80	--	--	7	4
Select red oaks	4,832	199	149	436	1,480	223	966	933	446
Other red oaks	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--
Yellow birch	12,551	1,890	171	1,670	1,577	2,037	864	2,548	1,794
Hard maple	62,127	8,096	1,308	8,166	8,572	6,948	3,527	16,830	8,680
Soft maple	9,885	1,177	609	625	1,612	1,230	738	2,515	1,379
Beech	519	5	11	--	--	--	--	503	--
Ash	1,507	121	125	429	73	179	88	124	368
Balsam poplar	1,108	99	486	--	53	20	--	434	16
Cottonwood	--	--	--	--	--	--	--	--	--
Bigtooth aspen	11,389	1,554	1,813	1,667	1,307	1,556	13	1,963	1,516
Quaking aspen	60,776	5,009	7,620	12,663	8,691	8,672	131	3,533	14,457
Basswood	4,466	314	284	788	598	765	138	826	753
Yellow-poplar	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--
Butternut	--	--	--	--	--	--	--	--	--
Elm	10,987	1,259	740	1,396	738	3,717	231	1,543	1,363
Paper birch	4,842	385	973	302	638	662	64	1,515	303
Other hardwoods[3/]	539	90	21	43	55	192	1	72	65
Total	185,622	20,198	14,313	28,185	25,474	26,201	6,761	33,346	31,144
All species	243,808	25,436	19,520	35,217	32,353	37,015	8,168	50,123	35,976

[1/]Removals in 1979 are trend-level removals.
[2/]International 1/4-inch rule.
[3/]Includes black cherry.

Table 56.--Timber removals[1] from growing stock and sawtimber on commercial forest land by species group, Western Upper Peninsula, Michigan, 1965 and 1979

Species group	Growing stock		Sawtimber	
	[2]1965	1979	[2]1965	1979
	Thousand cubic feet		[3]Thousand board feet	
SOFTWOODS				
White pine	1,325	2,409	7,876	12,010
Red pine	326	1,945	1,559	7,770
Jack pine	3,560	2,889	9,690	7,680
White spruce	1,679	1,100	8,437	4,233
Black spruce	1,703	921	3,689	956
Balsam fir	2,933	3,816	8,820	9,512
Hemlock	7,933	3,868	41,467	13,748
Tamarack	284	79	1,118	147
Northern white-cedar	1,522	976	3,279	2,130
Other softwoods	--	--	--	--
Total	21,265	18,003	85,935	58,186
HARDWOODS				
Select white oaks	123	23	797	94
Select red oaks	791	1,417	2,910	4,832
Other red oaks	--	--	--	--
Hickory	--	--	--	--
Yellow birch	5,263	3,224	29,703	12,551
Hard maple	15,300	14,549	79,954	62,127
Soft maple	2,559	6,075	6,358	9,885
Beech	353	101	1,921	519
Ash	257	547	1,207	1,507
Balsam poplar	73	651	326	1,108
Cottonwood	--	--	--	--
Bigtooth aspen	2,563	3,792	11,700	11,389
Quaking aspen	16,953	22,510	38,846	60,776
Basswood	840	1,153	4,426	4,466
Yellow-poplar	--	--	--	--
Black walnut	--	--	--	--
Butternut	--	--	--	--
Elm	993	3,351	5,454	10,987
Paper birch	537	2,574	2,001	4,842
Other hardwoods[4]	613	332	3,431	539
Total	47,218	60,299	189,034	185,622
All species	68,483	78,302	274,969	243,808

[1]Removals in 1979 are trend-level removals.
[2]Figures have been adjusted from those published after the 1966 survey to conform to 1980 volumes because of changes in survey definitions and procedures.
[3]International 1/4-inch rule.
[4]Includes black cherry.

Table 57.--Timber removals[1] from growing stock and sawtimber on commercial forest land by item and species category, Western Upper Peninsula, Michigan, 1979

Item	Growing stock						Sawtimber					
	All species	Pine	Other softwoods	Aspen	Hard maple	Other hardwoods	All species	Pine	Other softwoods	Aspen	Hard maple	Other hardwoods
	Thousand cubic feet						[2] Thousand board feet					
ROUNDWOOD PRODUCTS												
Pulpwood	36,241	3,481	6,371	15,922	2,939	7,528	72,030	8,170	16,948	26,997	7711	12,204
Saw logs	20,116	3,143	1,224	5,030	6,126	4,593	112,493	18,137	7,034	24,508	37,196	25,618
Fuelwood	645	[4]	7	40	307	291	2,147	7	23	140	1,009	968
Posts	333	--	333	--	--	--	343	--	343	--	--	--
Veneer logs	2,934	[4]	--	2,120	542	272	21,450	1	--	15,500	3,958	1,991
Poles	14	14	--	--	--	--	57	57	--	--	--	--
Other[3]	50	2	18	--	30	--	271	8	70	--	193	--
Total	60,333	6,640	7,953	23,112	9,944	12,684	208,791	26,380	24,418	67,145	50,067	40,781
LOGGING RESIDUE	4,391	281	378	1,314	1,212	1,206	8,744	423	927	1,998	3,160	2,236
OTHER REMOVALS	13,578	322	2,429	1,876	3,393	5,558	26,273	657	5,381	3,022	8,900	8,313
TOTAL REMOVALS	78,302	7,243	10,760	26,302	14,549	19,448	243,808	27,460	30,726	72,165	62,127	51,330

[1] Removals in 1979 are trend-level removals.
[2] International 1/4-inch rule.
[3] Includes charcoal wood, shingle bolts, cabin logs, particleboard bolts, piling, etc.
[4] Less than 500 cubic feet.

Table 58.--Net annual growth and removals[1/] of growing stock on commercial forest land by species group, Western Upper Peninsula, Michigan, 1979

(In thousand cubic feet)

Species group	Net annual growth	Annual timber removals
SOFTWOODS		
White pine	4,794	2,409
Red pine	3,030	1,945
Jack pine	3,999	2,889
White spruce	12,811	1,100
Black spruce	4,936	921
Balsam fir	16,748	3,816
Hemlock	6,260	3,868
Tamarack	841	79
Northern white-cedar	7,331	976
Other softwoods	86	--
Total	60,836	18,003
HARDWOODS		
Select white oaks	17	23
Select red oaks	2,599	1,417
Other red oaks	--	--
Hickory	--	--
Yellow birch	6,723	3,224
Hard maple	49,016	14,549
Soft maple	31,444	6,075
Beech	11	101
Ash	7,914	547
Balsam poplar	917	651
Cottonwood	6	--
Bigtooth aspen	2,295	3,792
Quaking aspen	15,664	22,510
Basswood	7,530	1,153
Yellow-poplar	--	--
Black walnut	--	--
Butternut	--	--
Elm	-1,291	3,351
Paper birch	8,873	2,574
Other hardwoods[2/]	2,117	332
Total	133,835	60,299
All species	194,671	78,302

[1/]Removals in 1979 are trend-level removals.
[2/]Includes black cherry.

Table 59.--Net annual growth and removals[1/] of sawtimber on commercial forest land by species group, Western Upper Peninsula, Michigan, 1979

(In thousand board feet)[2/]

Species group	Net annual growth	Annual timber removals
SOFTWOODS		
White pine	25,759	12,010
Red pine	12,329	7,770
Jack pine	21,954	7,680
White spruce	53,710	4,233
Black spruce	5,499	956
Balsam fir	44,394	9,512
Hemlock	37,543	13,748
Tamarack	3,722	147
Northern white-cedar	32,141	2,130
Other softwoods	8	--
Total	237,059	58,186
HARDWOODS		
Select white oaks	104	94
Select red oaks	15,496	4,832
Other red oaks	--	--
Hickory	--	--
Yellow birch	19,639	12,551
Hard maple	139,326	62,127
Soft maple	79,450	9,885
Beech	8	519
Ash	31,615	1,507
Balsam poplar	4,484	1,108
Cottonwood	27	--
Bigtooth aspen	17,011	11,389
Quaking aspen	93,060	60,776
Basswood	29,144	4,466
Yellow-poplar	--	--
Black walnut	--	--
Butternut	--	--
Elm	1,630	10,987
Paper birch	28,787	4,842
Other hardwoods[3/]	4,564	539
Total	464,345	185,622
All species	701,404	243,808

1/Removals in 1979 are trend-level removals.

2/International 1/4-inch rule.

3/Includes black cherry.

Table 60.--Net annual growth and removals[1/] of growing stock on commercial forest land by ownership class and softwoods and hardwoods, Western Upper Peninsula, Michigan, 1979

(In thousand cubic feet)

Ownership class	Net annual growth			Annual timber removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
National Forest	33,821	12,275	21,546	7,634	1,885	5,749
Bureau of Land Mgmt.	--	--	--	--	--	--
Miscellaneous federal	50	43	7	--	--	--
Indian	695	150	545	115	10	105
State	25,323	10,120	15,203	7,750	1,941	5,809
County and municipal	3,800	963	2,837	907	176	731
Forest industry	53,914	17,095	36,819	17,647	4,619	13,028
Farmer	9,397	2,198	7,199	[2/]44,249	[2/]9,372	[2/]34,877
Misc. private-corp.	29,208	6,970	22,238	--	--	--
Misc. private-indiv.	38,463	11,022	27,441	--	--	--
All owners	194,671	60,836	133,835	78,302	18,003	60,299

[1/]Removals in 1979 are trend-level removals.

[2/]Includes miscellaneous private-corporation and miscellaneous private-individual.

Table 61.--Net annual growth and removals[1/] of sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Western Upper Peninsula, Michigan, 1979

(In thousand board feet)[2/]

Ownership class	Net annual growth			Annual timber removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
National Forest	144,249	53,342	90,907	17,577	5,448	12,129
Bureau of Land Mgmt.	--	--	--	--	--	--
Miscellaneous federal	698	673	25	--	--	--
Indian	1,525	303	1,222	207	21	186
State	93,412	42,635	50,777	17,768	5,309	12,459
County and municipal	13,923	3,363	10,560	2,129	430	1,699
Forest industry	198,136	61,541	136,595	52,819	14,513	38,306
Farmer	31,396	6,370	25,026	[3]153,308	[3] /32,465	[3]/120,843
Misc. private-corp.	99,443	32,929	66,514	--	--	--
Misc. private-indiv.	118,622	35,903	82,719	--	--	--
All owners	701,404	237,059	464,345	243,808	58,186	185,622

[1/]Removals in 1979 are trend-level removals.

[2/]International 1/4-inch rule.

[3/]Includes miscellaneous private-corporation and miscellaneous private-individual.

Table 62.--Annual mortality of growing stock on commercial forest land by softwoods and hardwoods, Western Upper Peninsula, Michigan, 1965 and 1979

(In million cubic feet)

Species	1/1965	1979
Softwoods	10.3	14.0
Hardwoods	26.9	34.3
Total	37.2	48.3

1/Figures have been adjusted from those published after the 1966 survey to conform to 1979 volumes because of changes in survey definitions and procedures.

Table 63.--Annual mortality of growing stock on commercial forest land by species group and cause, Western Upper Peninsula, Michigan, 1979

(In thousand cubic feet)

Species group	All causes	Cause						
		Insects	Disease	Fire	Animals	Weather	Suppression	Unknown and other
SOFTWOODS								
White pine	241	5	132	--	--	13	--	91
Red pine	12	--	5	--	--	--	7	--
Jack pine	372	34	95	--	15	53	--	175
White spruce	890	110	61	--	--	268	9	442
Black spruce	1,015	53	259	--	10	202	10	481
Balsam fir	9,264	499	2,054	--	55	1,963	15	4,678
Hemlock	343	--	90	--	--	30	--	223
Tamarack	917	--	266	--	--	--	--	651
Northern white-cedar	918	--	276	--	40	171	--	431
Other softwoods	--	--	--	--	--	--	--	--
Total	13,972	701	3,238	--	120	2,700	41	7,172
HARDWOODS								
Select white oaks	2	--	2	--	--	--	--	--
Select red oaks	394	--	56	--	--	42	--	296
Other red oaks	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--
Yellow birch	2,328	--	989	--	--	158	--	1,181
Hard maple	5,774	--	2,003	--	216	1,381	61	2,113
Soft maple	1,447	--	594	--	--	158	--	695
Beech	2	--	--	--	--	--	--	2
Ash	906	--	296	--	--	--	--	610
Balsam poplar	791	--	460	--	--	122	--	209
Cottonwood	1	--	--	--	--	1	--	--
Bigtooth aspen	1,626	--	1,173	--	--	93	--	360
Quaking aspen	12,118	43	7,052	--	177	1,522	69	3,255
Basswood	781	--	219	--	--	187	--	375
Yellow-poplar	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--
Black cherry	230	--	31	--	--	--	--	199
Butternut	--	--	--	--	--	--	--	--
Elm	7,217	62	6,110	--	--	--	--	1,045
Paper birch	741	--	292	--	15	43	15	376
Other hardwoods	1	--	--	--	--	--	--	1
Total	34,359	105	19,277	--	408	3,707	145	10,717
All species	48,331	806	22,515	--	528	6,407	186	17,889

Table 64.--Annual mortality of sawtimber on commercial forest land by species group and cause, Western Upper Peninsula, Michigan, 1979

(In thousand board feet)[1/]

Species group	All causes	Cause						
		Insects	Disease	Fire	Animals	Weather	Suppression	Unknown and other
SOFTWOODS								
White pine	1,132	25	627	--	--	74	--	406
Red pine	--	--	--	--	--	--	--	--
Jack pine	1,231	--	808	--	153	--	--	270
White spruce	3,253	401	258	--	--	1,398	--	1,196
Black spruce	2,708	156	878	--	--	138	104	1,432
Balsam fir	14,382	636	3,712	--	198	4,623	--	5,213
Hemlock	1,645	--	416	--	--	143	--	1,086
Tamarack	1,375	--	1,375	--	--	--	--	--
Northern white-cedar	2,910	--	866	--	44	558	--	1,442
Other softwoods	1	--	--	--	--	--	--	1
Total	28,637	1,218	8,940	--	395	6,934	104	11,046
HARDWOODS								
Select white oaks	11	--	2	--	--	1	--	8
Select red oaks	1,362	--	244	--	--	--	--	1,118
Other red oaks	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--
Yellow birch	9,135	--	3,345	--	--	1,090	--	4,700
Hard maple	15,910	--	7,240	--	--	3,330	--	5,340
Soft maple	2,632	--	844	--	--	469	--	1,319
Beech	3	--	2	--	--	--	--	1
Ash	1,822	--	711	--	--	--	--	1,111
Balsam poplar	2,817	--	1,852	--	--	--	--	965
Cottonwood	3	--	2	--	--	--	--	1
Bigtooth aspen	4,440	--	3,316	--	--	1,124	--	--
Quaking aspen	25,180	--	9,683	--	598	6,461	--	8,438
Basswood	1,904	--	759	--	--	796	--	349
Yellow-poplar	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--
Black cherry	217	--	30	--	--	--	--	187
Butternut	--	--	--	--	--	--	--	--
Elm	18,675	164	15,813	--	--	--	--	2,698
Paper birch	1,273	--	535	--	--	349	--	389
Other hardwoods	1	--	1	--	--	--	--	--
Total	85,385	164	44,379	--	598	13,620	0	26,624
All species	114,022	1,382	53,319	--	993	20,554	104	37,670

[1/] International 1/4-inch rule.

Table 65.--Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Western Upper Peninsula, Michigan, 1979

Ownership class	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			[1/] Thousand board feet		
National Forest	9,734	2,723	7,011	20,697	5,035	15,662
Bureau of Land Management	--	--	--	--	--	--
Miscellaneous federal	239	7	232	574	21	553
Indian	33	31	2	95	88	7
State	6,692	2,612	4,080	14,244	4,588	9,656
County and municipal	927	208	719	2,018	428	1,590
Forest industry	11,869	3,475	8,394	31,007	7,123	23,884
Farmer	1,976	279	1,697	4,404	453	3,951
Misc. private-corp.	7,550	2,365	5,185	19,671	6,033	13,638
Misc. private-indiv.	9,311	2,272	7,039	21,312	4,868	16,444
All owners	48,331	13,972	34,359	114,022	28,637	85,385

[1/] International 1/4-inch rule.

Table 66.--Output of timber products by source of material and softwoods and hardwoods, Western Upper Peninsula, Michigan, 1978

Product	Standard units	Total		Roundwood products: Growing stock		Roundwood products: Nongrowing stock		Plant byproducts	
		No. of units	Thousand cubic feet	No. of units	Thousand cubic feet	No. of units	Thousand cubic feet	No. of units	Thousand cubic feet
PULPWOOD									
Softwood	1/Standard	143,486	11,327	124,805	9,852	13,301	1,050	5,380	425
Hardwood	cords	432,265	34,131	334,227	26,389	65,100	5,140	32,938	2,602
Total		575,751	45,458	459,032	36,241	78,401	6,190	38,318	3,027
SAW LOGS									
Softwood	2/Thousand	26,394	4,496	25,637	4,367	757	129	--	--
Hardwood	board feet	95,609	16,185	93,033	15,749	2,576	436	--	--
Total		122,003	20,681	118,670	20,116	3,333	565	--	--
VENEER LOGS									
Softwood	2/Thousand	1	--	1	--	--	--	--	--
Hardwood	board feet	21,449	2,934	21,449	2,934	--	--	--	--
Total		21,450	2,934	21,450	2,934	--	--	--	--
FUELWOOD									
Softwood	1/Standard	3,952	268	130	7	408	22	3,414	239
Hardwood	cords	57,453	4,005	9,179	638	24,960	1,735	23,314	1,632
Total		61,405	4,273	9,309	645	25,368	1,757	26,728	1,871
POSTS									
Softwood	Thousand	356	365	325	333	31	32	--	--
Hardwood	pieces	--	--	--	--	--	--	--	--
Total		356	365	325	333	31	32	--	--
POLES									
Softwood	Pieces	1,674	14	1,674	14	--	--	--	--
Hardwood		--	--	--	--	--	--	--	--
Total		1,674	14	1,674	14	--	--	--	--
OTHER 3/									
Softwood	Thousand	41	41	20	20	3	3	18	18
Hardwood	cubic feet	1,324	1,324	30	30	--	--	1,294	1,294
Total		1,365	1,365	50	50	3	3	1,312	1,312
ALL PRODUCTS									
Softwood	Thousand	--	16,511	--	14,593	--	1,236	--	682
Hardwood	cubic feet	--	58,579	--	45,740	--	7,311	--	5,528
Total		--	75,090	--	60,333	--	8,547	--	6,210

1/Rough-wood, 128 cubic foot basis.

2/International 1/4-inch rule.

3/Other (industrial production) includes cabin logs, charcoal wood, particleboard bolts, shingle bolts, piling, etc.

Table 67.--Output of roundwood products by source and softwoods and hardwoods, Western Upper Peninsula, Michigan, 1978

(In thousand cubic feet)

Product and species group	All sources	Growing-stock trees			Rough and rotten trees	Salvable dead trees	Other sources
		Total	Sawtimber	Poletimber			
INDUSTRIAL PRODUCTS							
Saw logs							
Softwood	4,496	4,367	4,298	69	1	47	81
Hardwood	16,185	15,749	14,725	1,024	121	11	304
Subtotal	20,681	20,116	19,023	1,093	122	58	385
Veneer logs and bolts							
Softwood	--	--	--	--	--	--	--
Hardwood	2,934	2,934	2,934	--	--	--	--
Subtotal	2,934	2,934	2,934	--	--	--	--
Pulpwood							
Softwood	10,902	9,852	6,533	3,319	210	216	624
Hardwood	31,529	26,389	11,820	14,569	2,808	261	2,071
Subtotal	42,431	36,241	18,353	17,888	3,018	477	2,695
Cooperage							
Softwood	--	--	--	--	--	--	--
Hardwood	--	--	--	--	--	--	--
Subtotal	--	--	--	--	--	--	--
Piling							
Softwood	2	2	2	--	--	--	--
Hardwood	--	--	--	--	--	--	--
Subtotal	2	2	2	--	--	--	--
Poles							
Softwood	14	14	12	2	--	--	--
Hardwood	--	--	--	--	--	--	--
Subtotal	14	14	12	2	--	--	--
Mine timbers (Round)							
Softwood	14	11	9	2	--	3	--
Hardwood	30	30	30	--	--	--	--
Subtotal	44	41	39	2	--	3	--
Posts (Round and split)							
Softwood	365	333	88	245	4	--	28
Hardwood	--	--	--	--	--	--	--
Subtotal	365	333	88	245	4	--	28
Other							
Softwood	7	7	4	3	--	--	--
Hardwood	--	--	--	--	--	--	--
Subtotal	7	7	4	3	--	--	--
All industrial products							
Softwood	15,800	14,586	10,946	3,640	215	266	733
Hardwood	50,678	45,102	29,509	15,593	2,929	272	2,375
Total	66,478	59,688	40,455	19,233	3,144	538	3,108
FUELWOOD							
Softwood	29	7	4	3	1	2	19
Hardwood	2,373	638	370	268	133	143	1,459
Total	2,402	645	374	271	134	145	1,478
ALL PRODUCTS							
Softwood	15,829	14,593	10,950	3,643	216	268	752
Hardwood	53,051	45,740	29,879	15,861	3,062	415	3,834
Total	68,880	60,333	40,829	19,504	3,278	683	4,586

Table 68.--Timber products from roundwood by species group and product, Western Upper Peninsula, Michigan, 1978

Species group	All Products		Pulpwood		Saw logs		Veneer logs	
	[1]Thousand cubic feet	Cords	[1]Thousand cubic feet	[2]Thousand board feet	[1]Thousand cubic feet	[2]Thousand board feet	[1]Thousand cubic feet	
SOFTWOODS								
White pine	2,254	5,419	429	10,856	1,822	1	--	
Red pine	1,963	13,346	1,053	5,323	893	--	--	
Jack pine	3,046	31,883	2,520	2,792	525	--	--	
White spruce	859	9,630	759	524	96	--	--	
Black spruce	720	8,063	636	438	81	--	--	
Balsam fir	3,410	42,593	3,362	63	12	--	--	
Hemlock	2,932	24,315	1,922	5,877	986	--	--	
Tamarack	44	533	40	24	4	--	--	
Northern white-cedar	601	2,324	181	497	77	--	--	
Other softwoods	--	--	--	--	--	--	--	
Total	15,829	138,106	10,902	26,394	4,496	1	--	
HARDWOODS								
Select white oaks	22	105	7	93	15	--	--	
Select red oaks	590	670	51	2,462	429	806	110	
Other red oaks	--	--	--	--	--	--	--	
Hickory	--	--	--	--	--	--	--	
Yellow birch	2,645	18,516	1,461	5,882	989	726	99	
Hard maple	12,799	60,111	4,747	39,288	6,343	3,958	542	
Soft maple	3,734	34,567	2,731	4,977	874	77	10	
Beech	102	263	21	481	81	--	--	
Ash	477	3,553	282	926	159	--	--	
Balsam poplar	685	8,564	674	61	11	--	--	
Cottonwood	--	--	--	--	--	--	--	
Bigtooth aspen	3,568	31,630	2,499	4,204	740	2,235	306	
Quaking aspen	21,171	187,759	14,832	24,956	4,390	13,265	1,814	
Basswood	818	2,457	193	3,535	619	40	5	
Yellow-poplar	--	--	--	--	--	--	--	
Black walnut	--	--	--	--	--	--	--	
Butternut	--	--	--	--	--	--	--	
Elm	3,285	20,354	1,607	7,161	1,257	232	32	
Paper birch	2,867	27,358	2,157	1,460	257	110	16	
Other hardwoods[3]	288	3,420	267	123	21	--	--	
Total	53,051	399,327	31,529	95,609	16,185	21,449	2,934	
All species	68,880	537,433	42,431	122,003	20,681	21,450	2,934	

(Table 68 continued on next page)

[1]Small quantities may round off to less than 500 cubic feet and will be shown as a dash in columns showing thousand cubic feet.

[2]International 1/4-inch rule.

[3]Includes black cherry.

(Table 68 continued)

Species group	Fuelwood		Posts		Poles		Other Products
	Cords	1/Thousand cubic feet	Thousand pieces	1/Thousand cubic feet	Pieces	1/Thousand cubic feet	1/Thousand cubic feet
SOFTWOODS							
White pine	73	3	--	--	--	--	--
Red pine	45	1	--	--	1,674	14	2
Jack pine	43	1	--	--	--	--	--
White spruce	--	--	4	4	--	--	--
Black spruce	--	--	3	3	--	--	--
Balsam fir	--	--	35	36	--	--	--
Hemlock	346	24	--	--	--	--	--
Tamarack	--	--	--	--	--	--	--
Northern white-cedar	31	--	314	322	--	--	21
Other softwoods	--	--	--	--	--	--	--
Total	538	29	356	365	1,674	14	23
HARDWOODS							
Select white oaks	--	--	--	--	--	--	--
Select red oaks	40	--	--	--	--	--	--
Other red oaks	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--
Yellow birch	1,407	96	--	--	--	--	--
Hard maple	16,263	1,137	--	--	--	--	30
Soft maple	1,727	119	--	--	--	--	--
Beech	--	--	--	--	--	--	--
Ash	558	36	--	--	--	--	--
Balsam poplar	--	--	--	--	--	--	--
Cottonwood	--	--	--	--	--	--	--
Bigtooth aspen	325	23	--	--	--	--	--
Quaking aspen	1,927	135	--	--	--	--	--
Basswood	28	1	--	--	--	--	--
Yellow-poplar	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--
Butternut	--	--	--	--	--	--	--
Elm	5,575	389	--	--	--	--	--
Paper birch	6,279	437	--	--	--	--	--
Other hardwoods	10	--	--	--	--	--	--
Total	34,139	2,373	--	--	--	--	30
All species	34,677	2,402	356	365	1,674	14	53

Table 69.--Volume of primary plant residue by kind of material and type of use, Western Upper Peninsula, Michigan, 1978

(In thousand cubic feet)

Type of use	Kind of wood residue							
	Total		Coarse[1]		Fine[2]		Bark[3]	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Fiber products[4]	374.1	3,778.5	368.8	3,727.1	5.3	51.4	15.0	107.0
Charcoal	--	--	--	--	--	--	--	--
Industrial fuel	193.2	1,431.5	21.6	90.8	171.6	1,340.7	174.0	1,252.2
Domestic fuel	45.7	200.5	45.7	200.5	--	--	17.4	90.3
Miscellaneous[5]	18.0	117.1	8.4	6.8	9.6	110.3	2.9	19.4
Not used[6]	103.6	1,839.2	19.2	57.1	84.4	1,782.1	83.4	1,565.3
Total	734.6	7,366.8	463.7	4,082.3	270.9	3,284.5	292.7	3,034.2

1/Suitable for chipping such as slabs, edgings, veneer cores, etc.
2/Not suitable for chipping such as sawdust, veneer clippings, etc.
3/Does not include bark disposal at pulpmills.
4/For manufacture of pulp, hardboard, or roofing felt.
5/Livestock bedding, mulch, small dimension, and specialty items.
6/Includes residue burned as waste.

Table 70.--All live shrub[1/] biomass yields on commercial forest land by shrub species group and forest type, Western Upper Peninsula, Michigan, 1980

(In pounds per acre)

Shrub spcies group	Forest type														
	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-soft maple	Maple-birch	Aspen	Paper birch	Exotic	Non-stocked
TALL SHRUBS															
Balsam fir	32.0	196.0	298.8	402.0	59.6	93.2	408.4	305.6	461.2	178.0	118.0	162.8	259.6	--	--
Tamarack	--	--	--	--	--	6.4	--	119.6	--	--	--	4.0	36.4	--	--
White spruce	--	--	--	9.2	10.8	--	10.4	--	71.6	20.8	4.8	--	18.0	--	--
Black spruce	32.8	--	--	31.6	--	460.0	14.8	248.0	--	21.2	--	--	--	--	--
Jack pine	64.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--
White pine	--	--	--	--	--	--	--	12.0	--	--	--	10.0	18.0	--	--
Northern white-cedar	--	--	--	310.0	--	5.2	542.8	44.0	--	65.6	5.2	21.6	48.4	--	--
Hemlock	--	--	--	--	--	--	--	--	--	21.2	15.2	--	--	--	--
Striped maple	--	--	--	--	--	--	--	--	--	--	4.0	--	--	--	--
Red maple	26.8	5.2	77.6	70.4	170.4	22.0	132.4	52.8	5.2	192.8	140.8	52.4	73.2	--	--
Sugar maple	--	--	175.2	32.8	59.6	81.6	46.8	--	150.8	110.0	853.2	158.0	50.4	--	--
Mountain maple	--	--	--	152.8	102.4	--	315.6	--	--	64.8	66.0	41.6	358.4	--	--
Speckled alder	--	--	7.6	955.2	280.8	1,952.4	757.2	2,718.0	--	397.2	38.4	225.6	132.0	--	56.4
Yellow birch	--	--	--	14.4	--	--	8.0	--	--	19.6	29.6	15.6	--	--	--
Paper birch	--	--	--	18.4	37.2	--	39.6	--	7.6	16.0	7.2	4.0	17.6	--	--
Swamp birch	--	--	--	--	--	18.0	--	--	--	--	--	--	--	--	--
American hornbeam	--	--	--	--	--	--	--	--	--	51.6	--	--	--	--	--
Flowering dogwood	--	--	--	--	--	4.4	--	--	--	--	--	--	--	--	--
Other dogwood	--	--	--	16.4	--	50.4	44.0	38.8	--	65.2	--	20.4	--	--	--
Hawthorn	--	--	--	--	--	--	--	--	--	--	--	4.0	--	--	--
White ash	--	--	--	--	--	--	--	--	--	18.4	4.8	28.4	--	--	--
Black ash	--	--	--	71.6	--	--	100.0	--	--	453.6	13.6	--	6.0	--	--
Mountain holly	--	--	--	--	--	4.8	--	--	--	--	--	--	--	--	--
Eastern hophornbeam	--	--	34.8	--	--	--	--	--	289.2	--	16.8	--	--	--	--
Balsam poplar	--	--	--	12.8	--	--	7.2	--	--	--	--	26.0	--	--	--
Bigtooth aspen	--	--	--	--	--	--	--	--	--	--	--	6.0	74.4	--	--
Quaking aspen	--	--	--	--	--	4.4	26.8	--	6.4	22.4	21.6	302.4	72.4	--	--
Pin cherry	--	--	--	--	10.0	--	--	--	--	--	--	4.8	--	--	5.6
Black cherry	63.2	--	21.2	17.2	11.6	4.0	--	--	--	240.4	24.4	24.8	30.4	--	-
Chokecherry	--	--	9.6	13.6	99.6	9.6	--	34.8	--	52.4	7.6	59.2	14.4	--	4.0
Sandcherry	10.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Northern red oak	--	42.4	--	--	--	--	--	--	60.8	10.8	12.0	5.6	29.6	--	--
Sweet gale	--	--	--	--	--	--	26.0	--	--	--	--	--	--	--	--
Mountain ash	--	--	--	--	--	--	--	--	--	10.4	4.8	4.0	--	--	--
Witch hazel	--	--	24.0	--	8.8	--	--	--	--	17.2	9.2	--	--	--	--
Juneberry	74.0	--	68.0	52.4	97.6	18.4	--	837.6	5.2	72.0	10.0	85.2	61.2	--	4.4
Hazel	--	--	446.4	68.8	132.4	--	221.2	96.0	242.8	184.8	192.8	443.6	119.6	--	--
Leatherwood	--	--	--	--	--	--	--	--	--	--	5.2	--	--	--	--
Viburnum	--	--	--	--	--	--	--	--	--	82.0	--	--	--	--	--
Elder	--	--	--	--	--	--	--	--	--	--	16.4	--	--	--	--
Sumac	--	--	--	--	--	--	--	--	--	--	--	4.4	--	--	--
Buffaloberry	--	--	--	--	--	--	--	--	--	--	--	7.6	--	--	--
Willow	--	68.8	5.2	10.8	295.6	6.8	30.4	822.0	--	141.2	10.4	42.0	6.0	--	--
American basswood	--	--	--	--	--	--	--	--	--	8.0	12.0	6.8	--	--	--
American elm	--	--	--	6.0	--	--	--	--	--	18.4	11.6	--	--	--	--
Total	304.0	312.4	1,168.4	2,266.4	1,376.4	2,741.6	2,731.6	5,329.2	1,300.8	2,556.0	1,655.6	1,770.8	1,426.0	--	70.4

(Table 70 continued on next page)

(Table 70 continued)

Shrub species group	Forest type														
	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-soft maple	Maple-birch	Aspen	Paper birch	Exotic	Non-stocked
LOW SHRUBS															
Yew	--	--	--	11.4	--	--	1.6	--	--	--	1.9	--	--	--	--
Labrador tea	--	--	--	95.8	15.4	228.0	8.4	--	--	3.3	--	--	--	--	--
Leatherleaf	--	--	--	--	--	20.4	--	378.3	--	3.4	--	--	--	--	--
Bog laurel	--	--	--	--	--	3.7	--	--	--	--	--	--	--	--	--
Sweetfern	19.5	1.5	--	--	4.4	--	--	1.2	--	--	--	8.0	--	--	4.8
Gooseberry-currant	--	--	--	--	--	--	4.4	6.2	--	--	--	2.3	--	--	--
Raspberry-blackberry	--	--	52.9	19.0	6.3	4.0	4.8	1.5	--	3.2	22.0	43.7	27.0	--	--
Rose	--	--	--	--	--	--	--	--	--	1.4	--	1.1	--	--	--
Black huckleberry	--	2.5	--	--	--	--	--	--	--	--	--	--	--	--	--
Bilberry-blueberry	565.8	151.7	46.9	20.6	14.3	113.1	3.0	83.3	2.6	16.8	3.0	18.0	11.2	--	128.3
Bush honeysuckle	--	11.1	16.9	3.6	6.8	--	--	6.9	--	3.7	--	3.1	1.3	--	--
Honeysuckle	--	5.8	2.9	6.2	8.2	3.0	3.8	6.3	--	1.4	5.5	11.6	3.6	--	--
Bearberry	--	11.1	--	--	--	2.8	--	--	--	--	--	--	--	--	--
Bog rosemary	--	--	--	--	--	5.2	--	--	--	--	--	--	--	--	--
Total	585.3	183.7	119.6	156.6	55.4	380.2	26.0	483.7	2.6	33.2	32.4	87.8	43.1	--	133.1
All shrubs	889.3	496.1	1,288.0	2,423.0	1,431.8	3,121.8	2,757.6	5,812.9	1,303.4	2,589.2	1,688.0	1,858.6	1,469.1	--	203.5
Number of plots 2/	20	8	14	32	84	73	10	13	9	61	834	163	43	--	5

1/Trees under 1.0-inch d.b.h. are also included. Tree and shrub species that averaged less than 1.0 pound per acre are not included.

2/Number of plots by forest type from which average yields were derived.

Table 71.--All live tree biomass yields on commercial forest land by species group and forest type, Western Upper Peninsula, Michigan, 1980

(In pounds per acre)

Shrub species group	Forest type														
	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-soft maple	Maple-birch	Aspen	Paper birch	Exotic	Non-stocked
SOFTWOODS															
White pine	1,387	9,814	68,994	3,114	6,207	1,475	1,297	601	3,084	719	1,207	1,550	2,228	--	617
Red pine	4,307	69,184	7,270	763	255	1,336	48	--	6,094	--	42	1,165	870	--	--
Jack pine	89,272	4,262	1,640	256	893	2,581	--	--	--	--	98	779	1,830	3,729	304
White spruce	185	1,013	7,483	10,312	51,651	1,471	2,260	88	730	3,485	1,815	3,346	3,609	--	--
Black spruce	2,216	1,169	3,466	5,385	3,426	36,322	5,952	9,549	1,080	1,444	221	745	1,378	--	813
Balsam fir	761	3,263	23,248	46,619	12,106	9,606	21,739	3,766	3,430	12,866	6,365	9,239	15,957	--	--
Hemlock	--	--	948	1,643	--	344	229	--	--	4,402	10,873	360	784	--	--
Tamarack	--	--	150	1,286	632	6,310	2,147	33,439	--	297	13	390	813	--	--
Northern white-cedar	--	--	879	7,565	3,046	8,613	61,615	3,153	--	9,313	2,266	689	3,858	--	--
Other softwoods	--	183	--	--	--	27	--	--	--	--	5	--	--	15,619	--
Total	98,128	88,888	114,078	76,943	78,216	68,085	95,287	50,596	14,418	32,526	22,905	18,263	31,327	19,348	1,734
HARDWOODS															
Select white oaks	--	--	--	--	--	--	--	--	--	--	--	170	--	--	--
Select red oaks	1,734	2,225	1,888	141	--	--	--	--	100,197	435	2,345	1,669	2,844	--	--
Other red oaks	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Yellow birch	--	--	544	3,830	241	1,192	3,400	--	2,411	9,938	16,856	1,139	882	--	--
Hard maple	143	938	7,883	2,283	3,251	209	1,488	--	23,625	7,829	70,745	7,545	9,912	--	49
Soft maple	1,200	2,128	9,757	9,336	3,728	3,145	5,169	368	16,872	24,700	22,163	9,510	15,316	--	--
Beech	--	--	--	--	--	--	--	--	--	--	30	--	--	--	--
Ash	--	--	351	1,331	--	978	2,916	131	589	39,768	3,191	1,366	745	--	--
Balsam poplar	--	115	--	1,385	65	178	1,219	648	--	512	230	2,940	708	--	--
Cottonwood	--	--	--	--	--	--	--	--	--	--	--	12	--	--	--
Bigtooth aspen	753	5,113	--	434	--	36	44	--	9,675	42	946	8,139	3,698	--	--
Quaking aspen	5,666	11,318	13,577	8,640	26,753	3,979	1,710	2,205	3,676	3,826	7,042	47,849	10,219	--	1,306
Basswood	--	--	305	57	--	--	--	--	--	1,099	7,253	559	294	--	--
Yellow-poplar	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Black cherry	240	762	--	1,339	392	242	107	--	--	484	2,141	948	614	--	--
Butternut	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Elm	--	--	303	1,265	700	81	206	--	--	7,973	5,486	1,565	286	--	--
Paper birch	608	5,808	19,075	6,910	3,795	3,096	7,250	1,093	6,939	2,977	2,577	7,449	68,893	--	1,289
Other hardwoods	--	93	--	--	--	--	--	--	--	137	37	--	--	--	--
Noncommercial species	77	--	50	148	52	601	380	--	93	230	2,458	527	625	--	--
Total	10,421	28,500	53,733	37,099	38,977	13,737	23,889	4,445	164,077	99,950	143,500	91,387	115,036	--	2,644
All species	108,549	117,388	167,811	114,042	117,193	81,822	119,176	55,041	178,495	132,476	166,405	109,650	146,363	19,348	4,378
Number of plots[1/]	39	22	23	199	21	119	135	22	14	101	1,321	378	79	1	13

[1/] Number of plots by forest type from which average yields were derived.

Table 72.--All live tree biomass on commercial forest land by species group and forest type, Western Upper Peninsula, Michigan, 1980

(In green tons)

Species group	All types	Forest type						
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
SOFTWOODS								
White pine	5,286,834	61,238	282,646	1,679,994	570,784	126,010	154,523	136,274
Red pine	3,258,078	190,137	1,992,506	177,018	139,819	5,182	139,956	5,073
Jack pine	4,980,396	3,941,355	122,740	39,936	47,005	18,137	270,386	--
White spruce	7,494,408	8,164	29,161	182,209	1,890,265	1,048,514	154,040	237,550
Black spruce	6,655,403	97,848	33,661	84,402	987,167	69,538	3,804,701	625,511
Balsam fir	26,059,064	33,600	93,977	566,098	8,545,280	245,761	1,006,223	2,284,829
Hemlock	13,844,227	--	--	23,081	301,204	--	36,024	24,102
Tamarack	1,982,235	--	--	3,653	235,743	12,829	661,010	225,635
Northern white-cedar	12,912,836	--	--	21,399	1,386,592	61,838	902,177	6,475,751
Other softwoods	26,568	--	5,275	--	--	--	2,834	--
Total	82,500,049	4,332,342	2,559,966	2,777,790	14,103,859	1,587,809	7,131,874	10,014,725
HARDWOODS								
Select white oaks	62,148	--	--	--	--	--	--	--
Select red oaks	4,979,212	76,562	64,073	45,974	25,877	--	--	--
Other red oaks	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--
Yellow birch	22,549,510	--	--	13,256	702,119	4,888	124,858	357,362
Hard maple	89,220,135	6,331	27,010	191,951	418,526	65,996	21,905	156,442
Soft maple	36,183,842	52,992	61,291	237,590	1,711,380	75,674	329,470	543,225
Beech	35,997	--	--	--	--	--	--	--
Ash	8,384,754	--	--	8,542	244,004	--	102,451	306,509
Balsam poplar	1,862,639	--	3,317	--	253,880	1,325	18,605	128,168
Cottonwood	4,244	--	--	--	--	--	--	--
Bigtooth aspen	4,754,106	33,258	147,253	--	79,626	--	3,788	4,668
Quaking aspen	30,686,466	250,149	325,971	330,589	1,583,673	543,082	416,787	179,675
Basswood	8,941,629	--	--	7,431	10,503	--	--	--
Yellow-poplar	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--
Black cherry	3,295,562	10,579	21,949	--	245,501	7,967	25,340	11,269
Butternut	--	--	--	--	--	--	--	--
Elm	8,062,100	--	--	7,377	231,899	14,211	8,520	21,682
Paper birch	14,199,168	26,845	167,283	464,484	1,266,587	77,042	324,270	762,029
Other hardwoods	57,868	--	2,681	--	--	--	--	--
Noncommercial species	3,309,778	3,407	--	1,206	27,071	1,047	62,914	39,917
Total	236,589,158	460,123	820,828	1,308,400	6,800,646	791,232	1,438,908	2,510,946
All species	319,089,207	4,792,465	3,380,794	4,086,190	20,904,505	2,379,041	8,570,782	12,525,671

(Table 72 continued on next page)

(Table 72 continued)

Species group	Forest type							
	Tamarack	Oak-hickory	Elm-ash-soft maple	Maple-birch	Aspen	Paper birch	Exotic	Non-stocked
SOFTWOODS								
White pine	10,819	34,849	61,030	1,431,461	568,191	160,158	--	8,857
Red pine	--	68,867	--	49,899	427,078	62,543	--	--
Jack pine	--	--	--	116,310	285,586	131,598	2,983	4,360
White spruce	1,578	8,246	295,679	2,152,745	1,226,795	259,462	--	--
Black spruce	171,881	12,199	122,521	262,255	272,995	99,053	--	11,671
Balsam fir	67,783	38,763	1,091,675	7,550,183	3,387,585	1,147,307	--	--
Hemlock	--	--	373,472	12,897,859	132,147	56,338	--	--
Tamarack	601,895	--	25,207	14,948	142,846	58,469	--	--
Northern white-cedar	56,751	--	790,175	2,687,991	252,768	277,394	--	--
Other softwoods	--	--	--	5,964	--	--	12,495	--
Total	910,707	162,924	2,759,759	27,169,615	6,695,991	2,252,322	15,478	24,888
HARDWOODS								
Select white oaks	--	--	--	--	62,148	--	--	--
Select red oaks	--	1,132,224	36,878	2,781,149	612,018	204,457	--	--
Other red oaks	--	--	--	--	--	--	--	--
Hickory	--	--	--	--	--	--	--	--
Yellow birch	--	27,243	843,278	19,995,541	417,543	63,422	--	--
Hard maple	--	266,959	664,292	83,920,940	2,766,368	712,705	--	710
Soft maple	6,627	190,649	2,095,816	26,290,929	3,486,951	1,101,248	--	--
Beech	--	--	--	35,997	--	--	--	--
Ash	2,351	6,654	3,374,330	3,785,548	500,820	53,545	--	--
Balsam poplar	11,671	--	43,476	273,183	1,078,117	50,897	--	--
Cottonwood	--	--	--	--	4,244	--	--	--
Bigtooth aspen	--	109,327	3,533	1,122,665	2,984,137	265,851	--	--
Quaking aspen	39,692	41,537	324,645	8,353,366	17,543,834	734,724	--	18,742
Basswood	--	--	93,290	8,604,305	204,983	21,117	--	--
Yellow-poplar	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--
Black cherry	--	--	41,046	2,540,326	347,447	44,138	--	--
Butternut	--	--	--	--	--	--	--	--
Elm	--	--	676,549	6,507,473	573,802	20,587	--	--
Paper birch	19,670	78,410	252,592	3,056,762	2,731,291	4,953,411	--	18,492
Other hardwoods	--	--	11,612	43,575	--	--	--	--
Noncommercial species	--	1,052	19,479	2,915,555	193,164	44,966	--	--
Total	80,011	1,854,055	8,480,816	170,227,314	33,506,867	8,271,068	--	37,944
All species	990,718	2,016,979	11,240,575	197,396,929	40,202,858	10,523,390	15,478	62,832

Table 73.--All live tree biomass by species group and tree biomass component, Western Upper Peninsula, Michigan, 1980

Species group	All components	Biomass component				
		1-to 5-inch trees	Growing stock		Cull	
			Boles	Tops and limbs	Boles	Tops and limbs
		-Green tons-				
SOFTWOODS						
White pine	5,286,834	127,464	3,441,508	1,563,551	93,959	60,352
Red pine	3,258,078	527,215	1,862,560	837,629	18,633	12,041
Jack pine	4,980,396	407,183	3,073,439	1,398,212	62,149	39,413
White spruce	7,494,408	1,311,025	4,139,174	1,951,885	53,550	38,774
Black spruce	6,655,403	2,890,867	2,536,294	1,184,575	25,362	18,305
Balsam fir	26,059,064	10,536,330	10,367,536	4,804,037	208,943	142,218
Hemlock	13,844,227	537,966	8,314,780	3,789,459	733,264	468,758
Tamarack	1,982,235	570,408	893,070	431,047	43,512	44,198
Northern white-cedar	12,912,836	2,849,899	5,450,125	2,703,626	1,028,712	880,474
Other softwoods	26,568	12,495	8,104	3,673	1,194	1,102
Total	82,500,049	19,770,852	40,086,590	18,667,694	2,269,278	1,705,635
HARDWOODS						
Select white oaks	62,148	--	27,907	13,355	13,715	7,171
Select red oaks	4,979,212	248,733	3,012,604	1,383,794	204,704	129,377
Other red oaks	--	--	--	--	--	--
Hickory	--	--	--	--	--	--
Yellow birch	22,549,510	2,201,162	10,397,103	4,973,163	2,814,435	2,163,647
Hard maple	89,220,135	16,215,427	44,706,352	21,011,074	4,448,251	2,839,031
Soft maple	36,183,842	7,182,064	17,374,435	8,299,622	1,979,117	1,348,604
Beech	35,997	1,311	14,897	6,883	7,867	5,039
Ash	8,384,754	2,203,031	3,943,263	1,796,957	260,948	180,555
Balsam poplar	1,862,639	246,118	1,058,582	507,159	29,071	21,709
Cottonwood	4,244	--	2,338	1,906	--	--
Bigtooth aspen	4,754,106	241,116	2,733,194	1,245,795	317,481	216,520
Quaking aspen	30,686,466	3,126,219	16,397,150	7,642,943	2,070,126	1,450,028
Basswood	8,941,629	744,481	5,301,552	2,347,069	329,719	218,808
Yellow-poplar	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--
Black cherry	3,295,562	623,872	1,503,761	686,950	295,746	185,233
Butternut	--	--	--	--	--	--
Elm	8,062,100	835,801	4,601,754	2,118,523	326,123	179,899
Paper birch	14,199,168	1,436,690	7,943,780	3,737,960	658,769	421,969
Other hardwoods	57,868	14,301	5,086	2,343	22,671	13,467
Noncommercial species	3,309,778	1,853,620	--	--	948,519	507,639
Total	236,589,158	37,173,946	119,023,758	55,775,496	14,727,262	9,888,696
All species	319,089,207	56,944,798	159,110,348	74,443,190	16,996,540	11,594,331

(Table 73 continued on next page)

(Table 73 continued)

Species group	All components	Biomass component: 1-to 5-inch trees	Growing stock: Boles	Growing stock: Tops and limbs	Cull: Boles	Cull: Tops and limbs
			Thousand cubic feet			
SOFTWOODS						
White pine	292,146	7,052	190,184	86,404	5,180	3,326
Red pine	158,591	25,562	90,721	40,799	916	593
Jack pine	209,474	16,949	129,331	58,842	2,661	1,691
White spruce	425,261	74,279	234,963	110,800	3,029	2,190
Black spruce	407,382	176,541	155,547	72,649	1,539	1,106
Balsam fir	1,189,138	481,111	472,737	219,056	9,637	6,597
Hemlock	584,706	22,392	350,531	159,787	31,613	20,383
Tamarack	86,588	25,073	38,837	18,745	1,937	1,996
Northern white-cedar	882,671	194,201	374,884	185,972	68,971	58,643
Other softwoods	1,304	593	403	183	65	60
Total	4,237,261	1,023,753	2,038,138	953,237	125,548	96,585
HARDWOODS						
Select white oaks	2,212	--	990	473	492	257
Select red oaks	174,339	8,540	105,360	48,400	7,341	4,698
Other red oaks	--	--	--	--	--	--
Hickory	--	--	--	--	--	--
Yellow birch	847,495	81,525	388,183	185,720	108,245	83,822
Hard maple	3,384,326	610,176	1,695,220	796,720	171,979	110,231
Soft maple	1,567,902	309,906	752,305	359,387	86,893	59,411
Beech	1,412	51	581	268	312	200
Ash	339,598	87,945	160,150	72,981	10,833	7,689
Balsam poplar	94,556	12,446	53,750	25,752	1,490	1,118
Cottonwood	186	--	102	84	--	--
Bigtooth aspen	227,774	11,455	130,797	59,620	15,388	10,514
Quaking aspen	1,465,085	148,514	782,060	364,541	99,886	70,084
Basswood	445,285	36,856	263,952	116,859	16,570	11,048
Yellow-poplar	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--
Black cherry	149,617	27,945	68,232	31,175	13,623	8,642
Butternut	--	--	--	--	--	--
Elm	316,412	32,490	180,661	83,170	12,922	7,169
Paper birch	590,602	59,800	330,020	155,290	27,691	17,801
Other hardwoods	2,427	595	213	98	954	567
Noncommercial species	139,339	77,154	--	--	40,496	21,689
Total	9,748,567	1,505,398	4,912,576	2,300,538	615,115	414,940
All species	13,985,828	2,529,151	6,950,714	3,253,775	740,663	511,525

Table 74.--Sampling errors[1/] for estimates smaller than the Unit totals of volume, net growth, removals, and area of commercial forest land, Western Upper Peninsula, Michigan, 1980

Sampling error	Commercial forest area	Growing Stock: Inventory	Growing Stock: Growth	Growing Stock: Removals	Sawtimber: Inventory	Sawtimber: Growth	Sawtimber: Removals
Percent	Thousand acres	Million cubic feet			[2/]Million board feet		
1	972.9	5,631.5	429.1	13,257.9	39,389.7	6,615.0	61,065.1
2	243.2	1,407.9	107.3	3,314.5	9,847.4	1,653.8	15,266.3
3	108.1	625.7	47.7	1,473.1	4,376.6	735.0	6,785.0
4	60.8	352.0	26.8	828.6	2,461.9	413.4	3,816.6
5	38.9	225.3	17.2	530.3	1,575.6	264.6	2,442.6
10	9.7	56.3	4.3	132.6	393.9	66.2	610.7
15	4.3	25.0	1.9	58.9	175.1	29.4	271.4
20	2.4	14.1	1.1	33.1	98.5	16.5	152.7
25	1.6	9.0	0.7	21.2	63.0	10.6	97.7
50	0.4	2.3	0.2	5.3	15.8	2.6	24.4
100	0.1	0.6	0.0	1.3	3.9	0.7	6.1

[1/]At the 68-percent probability level.
[2/]International 1/4-inch rule.

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Spencer, John S., Jr.
Timber Resource of Michigan's Western Upper Peninsula, 1980.
Resour. Bull. NC-60. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1982. 102 p.

The fourth inventory of the timber resource of Michigan's Western Upper Peninsula Survey Unit shows an 8-percent decline in commercial forest area and a 22-percent gain in growing-stock volume between 1966 and 1980. Presented are highlights and statistics on area, volume, growth, mortality, removals, utilization, and biomass.

KEY WORDS: Timber resource, statistics, area, volume, growth, mortality, removals.